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North Carolina Department of Transportation
Statewide Planning Branch
Small Urban Planning Unit

Town of Boiling Springs Thoroughfare Plan

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Thoroughfare Plan for the Town of Boiling Springs

Prepared by the:

Statewide Planning Branch
Division of Highways
North Carolina Department of Transportation

In Cooperation with:

The Town of Boiling Springs
The Federal Highway Administration
U. S. Department of Transportation

June 1997

Wesley O. Stafford, P.E.
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Acknowledgments

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Executive Summary

This plan documents the findings of a thoroughfare study for the Town of Boiling Springs. Below is a listing and brief description of the recommendations discussed in this report. The figure on the following page displays the recommendations on the thoroughfare plan.

Major Thoroughfares

1) E. College Avenue (NC 150E) - this facility is recommended to be a three lane curb and gutter section from Main St. to the Eastern City Limits(ECL) and a multilane section from the ECL to Skinner Road.

2) W. College Avenue (SR 1003) - this facility is recommended to be widened to a multilane facility to the Western City Limits(WCL). Beyond the city limits the facility should be widened to 24' with shoulders.

3) S. Main St. (NC 150 S.) - the section of roadway from Branch Avenue to SR 1003 should be widened to a multilane section. No other recommendations are suggested.

4) Eastern Bypass - extend Patrick Avenue and construct a two lane facility partly on new location on the east side of town. This alleviates congestion in the downtown area by reducing the number of through trips on Main Street.

5) Western Bypass - extend W. Homestead Avenue to Patrick Avenue and construct a two lane facility on the west side of town. In conjunction with the Eastern Bypass this will create a complete loop around town and will help with the movement of traffic.

6) Skinner Road (SR 1158) - widen this facility to 24' with paved shoulders.

Minor Thoroughfares

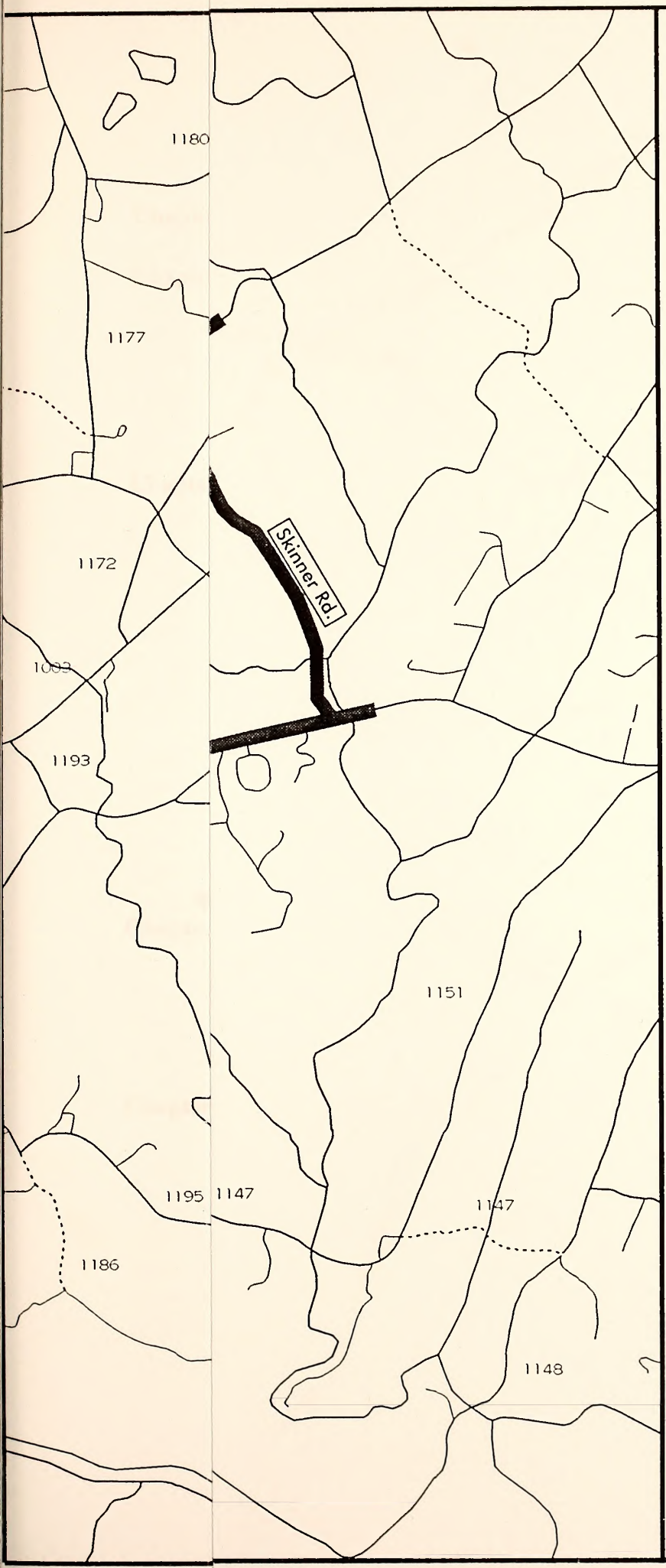
7) Hillcrest Street Extension - extend from existing Hillcrest Street to Oak Avenue

8) Stadium Drive Extension - extend from existing Stadium Drive to Flint Hill Church Road.

9) College Farm Road - this facility is proposed to be widened and straightened to the intersection of Clyde Wallace Road (SR 1196).

Intersection Improvement

10) College Avenue and Main Street - Recommended to replace existing signal system with an actuated signal system as well as the addition of exclusive turn lane signals. A parking study is also underway and will offer suggestions as to whether or not to remove the on street parking.



September 3, 1996

EXECUTIVE SUMMARY LOCATION OF RECOMMENDATIONS

LEGEND

	existing	proposed
Major Thoroughfare	▬▬	■ ■ ■
Minor Thoroughfare	▬▬	- - -

ADOPTED BY:

TOWN OF BOILING SPRINGS	October 1, 1996
PUBLIC HEARINGS	September 3, 1996
RECOMMENDED BY STATEWIDE PLANNING	November 6, 1996
N.C. DEPARTMENT OF TRANSPORTATION	December 6, 1996

BOILING SPRINGS

CLEVELAND COUNTY
NORTH CAROLINA

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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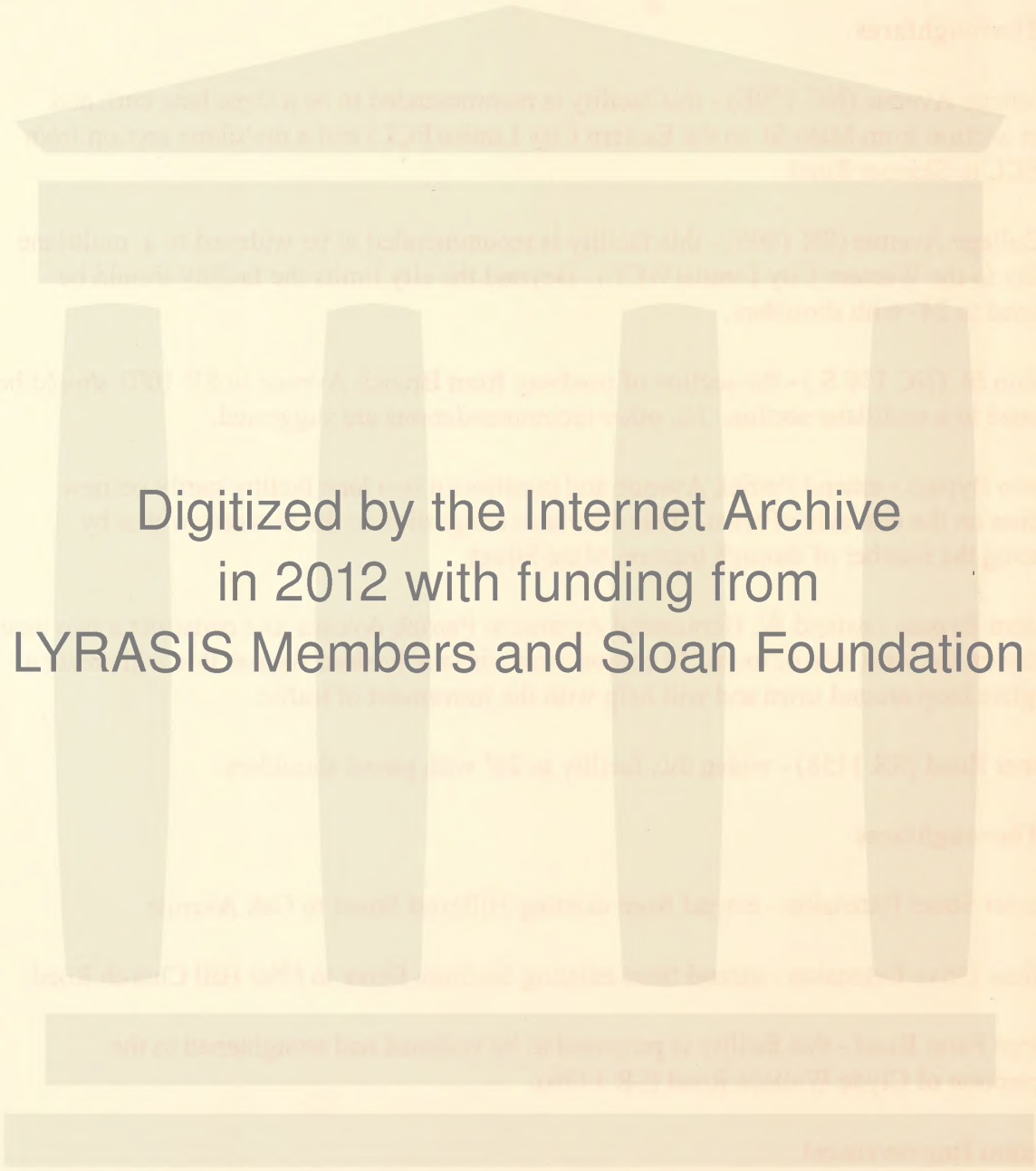

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September 3, 1996

EXECUTIVE SUMMARY LOCATION OF RECOMMENDATIONS

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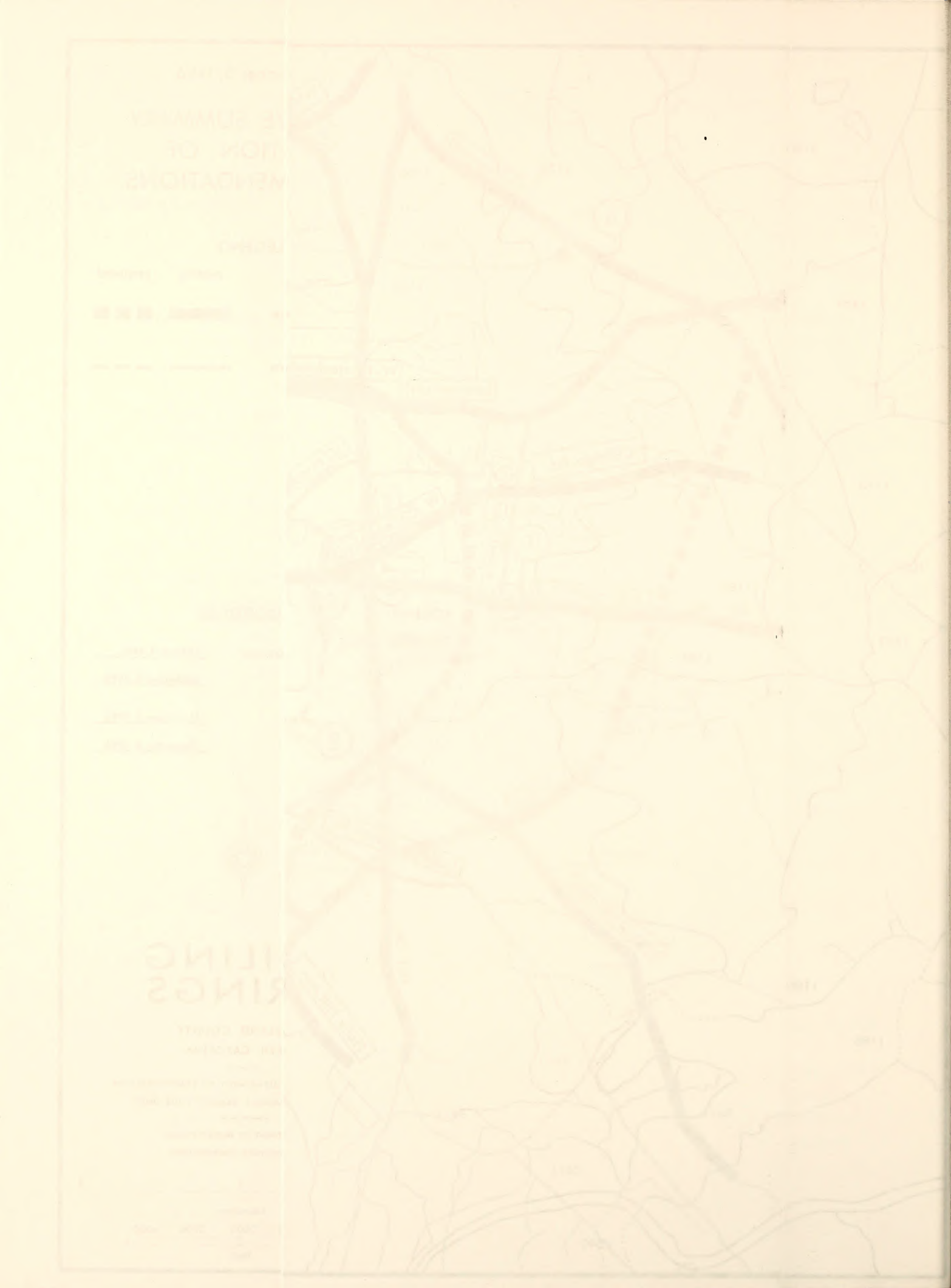

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Chapter 1

INTRODUCTION

The Town of Boiling Springs is a small residential community located in the southwestern corner of Cleveland County near the South Carolina State Line. The Town is located eight miles southwest of Shelby and 15 miles north of Gaffney, South Carolina. The geographical location of Boiling Springs is shown in Figure 1.

The Town of Boiling Springs is named for an underground spring located on the campus of Gardner-Webb University. Measuring 4 or 5 feet across and bubbling up to eight inches above the surface, the spring was an attraction, where folks from miles around came to drink from the spring. The spring is no longer bubbling but there are plans in process for putting the bubble back into the spring. Named in 1843, a short time after Cleveland County was chartered, the Town became incorporated in 1911. The first settlers were of Scotch-Irish descent and migrated from Lancaster County, Pennsylvania.

The Town of Boiling Springs requested the assistance of the Department of Transportation in developing a Thoroughfare Plan. With the help of the Town Board, the Planning Board and local citizens this recommended thoroughfare plan was developed for Boiling Springs. This report documents the findings of a study of Boiling Springs' Thoroughfare system that began in July 1995 and culminated in the mutual adoption of the Boiling Springs Thoroughfare Plan in October of 1996. The adopted plan is shown in Figure 2.

Thoroughfare Plans are long range forecasts of transportation needs due to increases in traffic demands on the system. The principles of basic thoroughfare planning, as described in Chapter 7 were used to develop this plan. Based on existing traffic, population, and land use data, the average daily traffic for the year 2020 was projected and used to determine systemwide capacity deficiencies. The recommendations for improvements to major and minor arterials and collectors were based on field investigations, existing and anticipated land uses, the expected system deficiencies and environmental considerations. The adopted Thoroughfare Plan is expected to meet the demands of Boiling Springs for the planning period of 1994-2020.

The North Carolina Department of Transportation and the Town of Boiling Springs are jointly responsible for the proposed thoroughfare plan improvements. Cooperation between the state and local governmental units is of primary concern. The plan has been mutually adopted by all parties and it is the responsibility of the local government to implement the plan following the guidelines set forth in Chapter 3.

It should be emphasized that the recommended plan is based on anticipated growth of the urban area as indicated by current trends. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations and design requirements.

GEOGRAPHIC LOCATION FOR BOILING SPRINGS

CLEVELAND COUNTY, NORTH CAROLINA

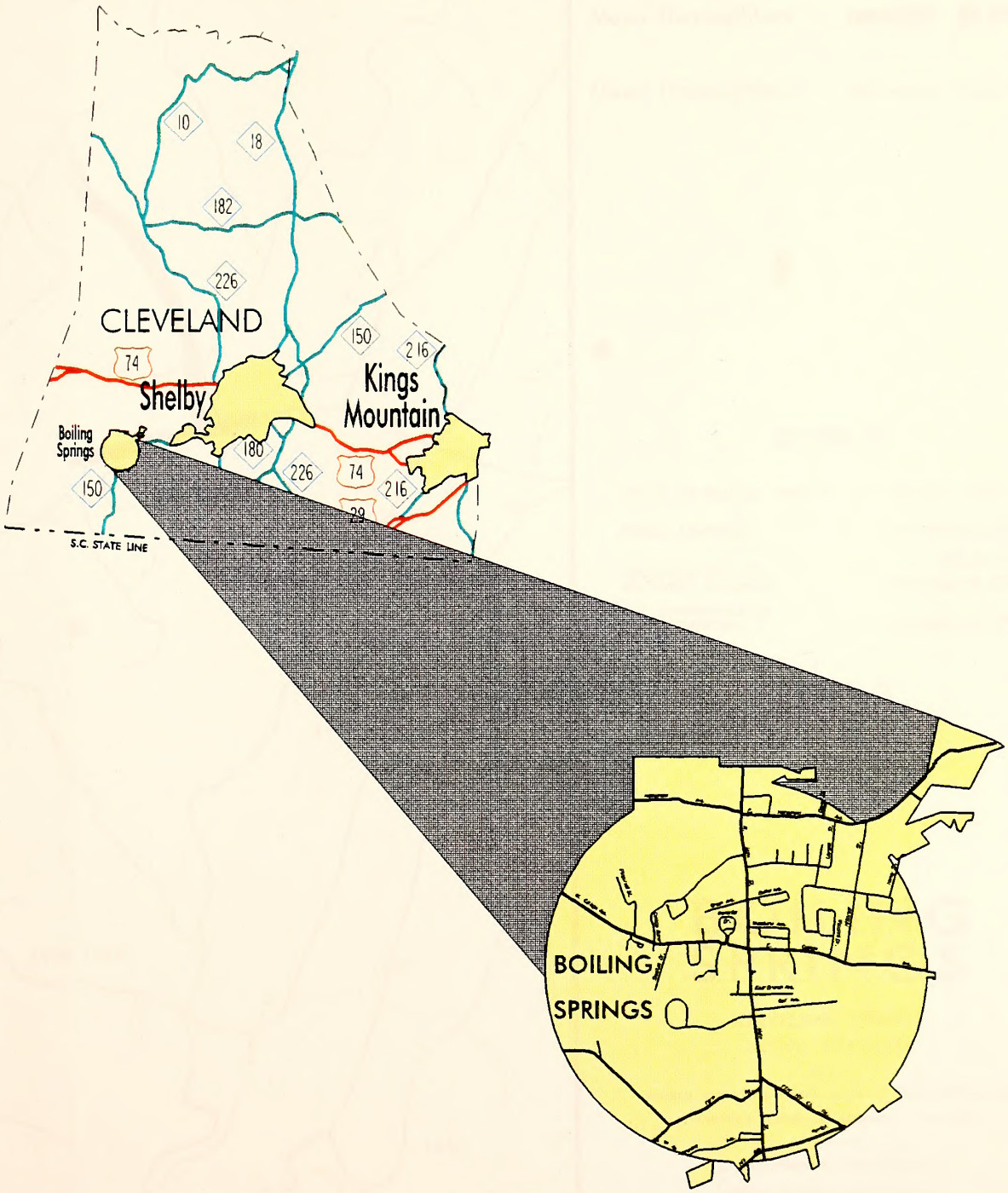
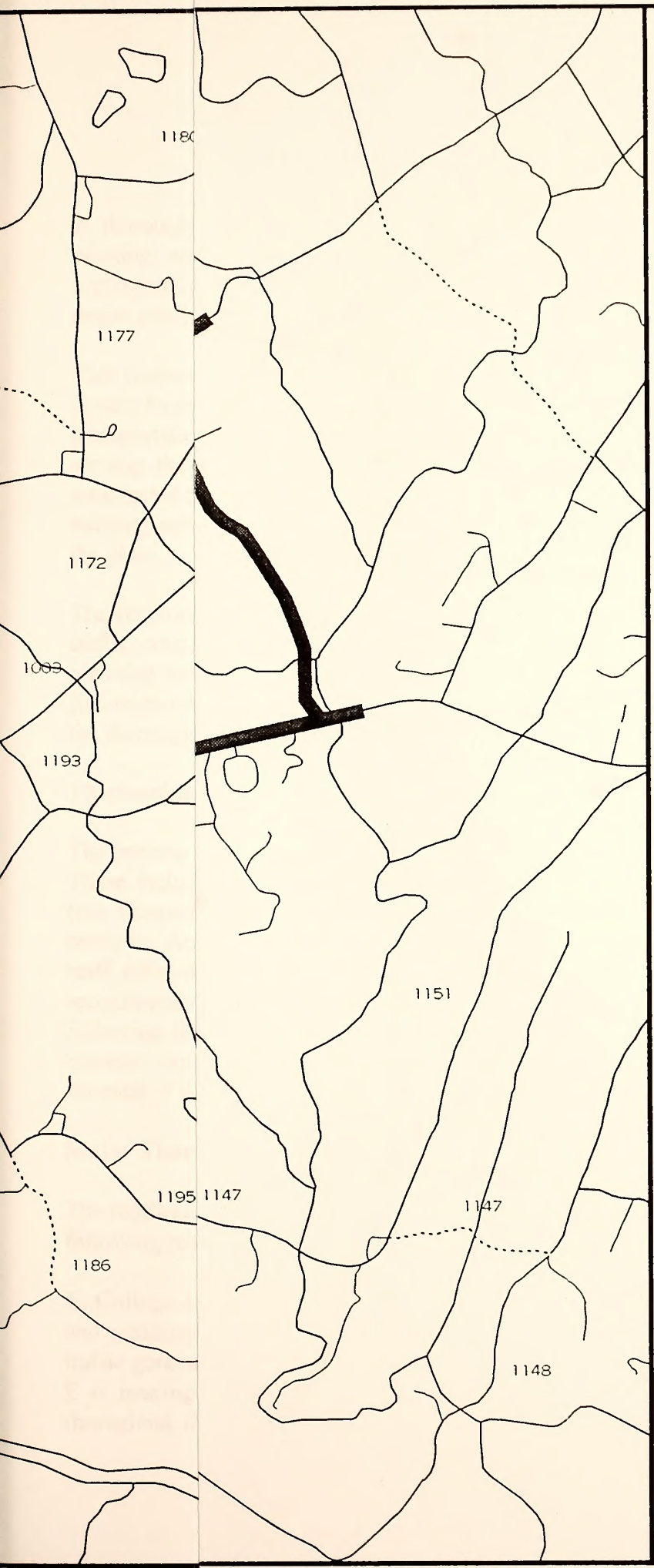


FIGURE 1



September 3, 1996

THOROUGHFARE PLAN

LEGEND

	existing	proposed
Major Thoroughfare	▬▬	▪ ▪ ▪
Minor Thoroughfare	▬▬	▪ ▪ ▪

ADOPTED BY:

TOWN OF BOILING SPRINGS	October 1, 1996
PUBLIC HEARINGS	September 3, 1996
RECOMMENDED BY STATEWIDE PLANNING	M.R. Poole November 6, 1996
N.C. DEPARTMENT OF TRANSPORTATION	December 6, 1996

FIGURE 2

BOILING SPRINGS

CLEVELAND COUNTY
NORTH CAROLINA

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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GEOGRAPHIC LOCATION FOR BOILING SPRINGS

CLEVELAND COUNTY, NORTH CAROLINA

September 3, 1996

THOROUGHFARE PLAN

LEGEND

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Major Thoroughfore	▬▬	▬ ▬ ▬
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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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Chapter 2

RECOMMENDED THOROUGHFARE PLAN

A thoroughfare plan study uncovers the need for new facilities and at the same time identifies existing and future deficiencies in the transportation system. A thoroughfare plan is a representation of the existing highway system by functional use. The various uses are classified as major arterials, minor arterials, collector street system, or the local street system.

This chapter presents the thoroughfare recommendations based on the ability of the existing street system to serve present and future travel demands as the area continues to grow. The usefulness of transportation planning is in the analysis of different highway configurations for their efficiency in serving the area. The recommended plan sets forth a system of thoroughfares to serve the anticipated traffic and land development needs for the Boiling Springs area. The need to eliminate existing and projected system deficiencies that cause traffic congestion is the primary objective of the plan.

The recommended thoroughfare plan is based on the results of traffic forecasts that use data on traffic counts, population, housing and employment. Each major street and highway in the planning area is analyzed to determine its ability to serve existing and future traffic demands. Recommendations to improve the transportation deficiencies in the system are then presented in the thoroughfare plan for the Town of Boiling Springs.

Thoroughfare Plan Recommendations

The process of developing, testing and evaluating alternate plans involved several considerations. These included the goals and objectives of the Town of Boiling Springs, identified deficiencies (see Chapter 4), environmental impacts, existing and anticipated land development, and travel services. Aerial photography, topographic mapping, field reconnaissance and discussion with local staff, officials, and interested local citizens provided additional basis for identifying and evaluating recommendations of major and minor thoroughfares in the Boiling Springs Planning Area. The following list describes the recommendations for the major and minor thoroughfares in Boiling Springs. Appendix A provides a detailed list of each facility in the area and the recommendations for each of them. Appendix C describes the typical cross section for each type of facility.

Major Thoroughfare Systems

The roadways serving as major thoroughfares are the primary traffic arteries of the urban area. The following roadways are the primary traffic movers in the Boiling Springs Planning Area.

E. College Ave. (NC 150 E.)- This facility connects Boiling Springs directly to Shelby in the east and continues into the Town of Cherryville in Gaston County. Garner-Webb University is a major traffic generator along this heavily traveled route. The traffic data in this report indicates NC 150 E is nearing capacity and by the year 2020 will be over capacity. NC 150 varies in width throughout the corridor because of on street parking. It is 55 feet wide where it crosses Main

Street with only three lanes of travel. If on street parking is removed it is possible to have four lanes without additional widening of the roadway.

The Cleveland County Comprehensive Land Use Plan which was prepared by The Isothermal Planning and Development Commission has projected the expansion of commercial and industrial land use along NC 150. Therefore, it is expected that the traffic volumes will drastically increase causing additional lanes to be needed. In the Cleveland County Thoroughfare Plan which was adopted on March 19, 1996, NC 150 is recommended to be widened to a multilane facility from Boiling Springs to the Gaston County line.

W. College Ave. (SR 1003)- This two lane facility along with East College Avenue (NC 150 E) is the main east-west route through Boiling Springs. Gardner-Webb University is located at the intersection of W. College Avenue and Main StreetTraffic. Data indicates this facility is operating near capacity and it will be over capacity by the year 2020. It is recommended to widen this facility to multi-lanes up to the town's western city limits. Beyond the city limits SR 1003 extends to Rutherford County and should be widened to 24' wide with shoulders to meet the minimum lane width criteria.

N. Main Street (SR 1161)- This facility is a major north-south facility and crosses US 74 Business to the north. The town's Post Office is at the intersection of N. Main Street and W. College Avenue. The traffic congestion that is created by the Post Office is a source of great concern for the citizens of Boiling Springs. The recommended improvements to this intersection which is covered in detail later in this chapter, will help the congestion, but the only permanent solution will be to relocate the Post Office in the future. N. Main Street is projected to be near capacity in the design year. The Eastern Bypass will reduce through trips and will improve capacity on this facility.

S. Main Street (NC 150 S.)- This facility's width varies from 55' to 18' wide and extends south to Gaffney, South Carolina. The Cleveland County Thoroughfare Plan recommends widening the facility to a 24′ cross section to Gaffney, SC. Gardner-Webb University is located in the corner of S. Main Street and West College Avenue. There are a number of local businesses with on street parking off of this road. This facility carries external-internal traffic due to people who live in Gaffney and attend the University in Boiling Springs as well as through traffic from Gaffney to Shelby. This facility will be over capacity in 2020. The Town of Boiling Springs has started the preliminary planning of a Park and Nature trail off of NC 150 S. This park will generate added traffic in the future.

Eastern Bypass

Patrick Ave. (SR 1149)- It is recommended to realign and extend this facility to the intersection of E. Homestead Ave. and Skinner Road. The construction of this facility will reduce the number of passenger vehicles and remove through traffic traveling into town. This facility also can provide an eastern loop for local traffic. The construction of this corridor will provide local traffic easier access to the central business district. With the increase in housing development in Boiling Springs, this Bypass will help with the overall flow of traffic.

Initially this will be a two lane limited controlled access facility just east of town with 60 m (200 ft) of right-of-way. As traffic demand increases the facility can be upgraded to a four lane cross section. The proposed alignment was kept close to town so it also would act as a partial loop for local traffic.

Long Range Bypass (West Side Loop)
Extension of SR 1149 (Patrick Ave.) To SR ll58 (W. Homestead Ave.)
This project is seen as long range to aid in the movement of traffic through Boiling Springs beyond the year 2020. This future bypass uses Holly Hill Avenue by connecting to W. Homestead Avenue at the intersection of Homestead and College Avenue creating a loop to the west of Boiling Springs. This bypass in conjunction with the bypass in the east will create a loop around the town of Boiling Springs. Since this loop is close to town, it will be accessible and convenient for the residents to utilize. This facility is proposed to be two lanes with a 60 ft right-of-way to allow for possible future widening.

Homestead Avenue (SR 1158)- This is a two lane facility with variable lane widths of 18′ to 22′. Homestead Avenue runs east-west near the northern Town limits of Boiling Springs. The current traffic volume is below capacity. In the design year this facility will connect the eastern and western bypass and is projected to carry a greater volume of traffic. It is recommended to widen this facility to 24' wide with paved shoulders to meet the minimum lane width criteria. The improvement includes the widening of West Homestead Avenue from the intersection of North Main Street (SR 1161) to the intersection of Cliffside Road (SR 1003).

Skinner Road (SR 1158)- Skinner Road is a two lane facility that runs from SR 1161 in the north to NC 150 in the east. This facility is 18' feet wide which is acceptable for the current traffic volume. With the increase in housing development along this road and the proposed future Eastern Bypass the traffic volume is likely to increase and it is recommended to widen this facility to 24' with paved shoulders.

Flint Hill Church Road (SR 1148)- This two lane facility is classified as a Major Thoroughfare and is 18' wide, the current traffic volume meets the lane width criteria. No improvements are recommended for this facility at this time.

Minor Thoroughfare System

The roadways serving as minor thoroughfares collect traffic from local access streets in the Boiling Springs Planning Area and carry it to the major thoroughfares.

Hillcrest Street Extension- It is recommended to extend Hillcrest Street to cross Oak Avenue. This extension will create a continuity in the minor thoroughfares and will help reduce the traffic on Main Street.

Dehart Drive- This radial route in the southwest portion of the planning area connects N. Main Street to College Manor Road. No improvements are recommended for this facility at this time.

Stadium Drive Extension- It is recommended to extend Stadium Drive to Flint Hill Church Road. This proposed route will create a radial which will improve the flow of traffic from the south to west of town and reduce traffic on the Main Street.

College Farm Road- The lane width on this facility varies from 16' to 28' and has a very low average daily traffic (60-325 ADT). The Transportation Partnership's new proposal includes the widening and straightening of College Farm Road from the intersection of NC 150 to the intersection of Clyde Wallace Road (SR 1196). No other recommendations are proposed at this time.

Intersection Improvement

College Avenue and Main Street- This intersection is located in the heart of Boiling Springs. The Post Office, University, various shops and a gas station are located on the four corners of this intersection and there is currently on street parking. The congestion and ease of turning movement is a problem at this intersection. After some investigation the problems were determined to be:

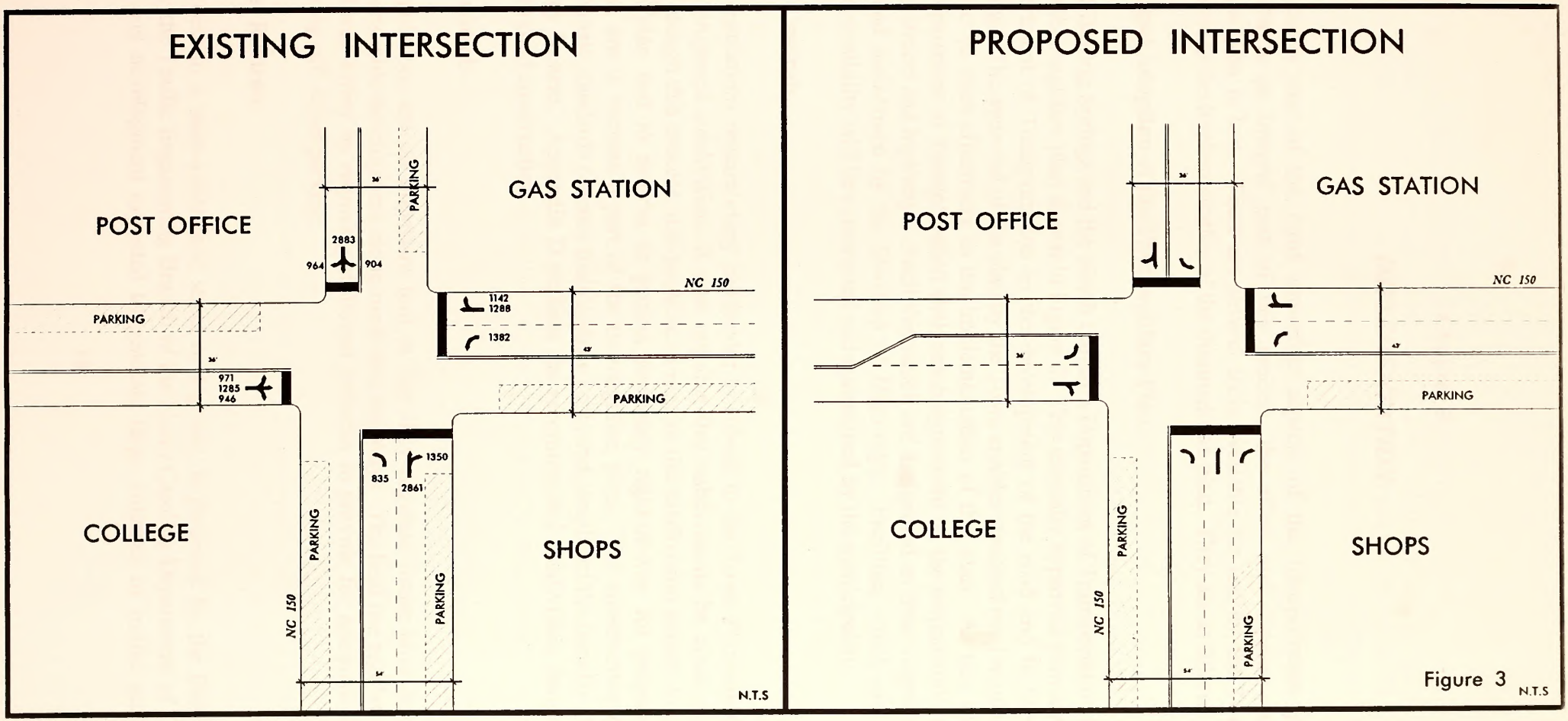
- The traffic signal that is currently in place is a pre-timed traffic signal and will not respond to the peak hour traffic problems or a seasonal change in traffic based on University breaks and various activities in this area.

-Parking on the street is taking space that should be used for the addition of turn lanes on the roadways.

The recommended solutions and actions that were taken are as follows:

NCDOT's Statewide Planning Branch along with the Town of Boiling Springs has requested that the Division Engineer replace the existing traffic signal controller with an actuated signal system and to upgrade the signal design to include exclusive turn lane signals. A parking study was also completed and presented to the Town Board on May 6, 1997. The parking study should help the Town officials make a decision about the parking problem and take the necessary steps to resolve it.

Figure 3 shows a sketch of the existing intersection and the proposed intersection.


EXISTING INTERSECTION
POST OFFICE
GAS STATION
COLLEGE
SHOPS
NC 150
PARKING
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1285
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835
2861
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N.T.S
PROPOSED INTERSECTION
POST OFFICE
GAS STATION
COLLEGE
SHOPS
NC 150
PARKING

Figure 3

Chapter 3

IMPLEMENTATION

Implementation is one of the most important aspects of the transportation plan. Unless implementation is an integral part of this process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the Town of Boiling Springs to assist in the implementation of the thoroughfare plan. They are as follows:

State-Municipal Adoption of the Thoroughfare Plan

The Town of Boiling Springs and the North Carolina Department of Transportation have mutually approved the thoroughfare plan shown in Figure 2. This mutually approved plan serves as a guide for the Department of Transportation in the development of the road and highway system for Boiling Springs. The approval of the plan by the Town enables standard road regulations and land use controls to be used effectively in the implementation of this plan. As part of the plan, the Town and Department of Transportation shall reach agreement on the responsibilities for existing and proposed streets and highways. Facilities which are designated as State responsibility will be constructed and maintained by the Division of Highways. Facilities which are designated as municipal responsibility will be constructed and maintained by the municipality.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the Town Planning Commission a plan of any proposed subdivision. It also requires that subdivisions be constructed to certain standards. Through this process, it is possible to require the subdivision streets do conform to the thoroughfare plan and to reserve or protect necessary right-of-way for projected roads and highways that are to become a part of the thoroughfare plan. The construction of subdivision streets to adequate standards reduces maintenance costs and simplifies the transfer of streets to the State Highway System. Appendix D outlines the recommended subdivision design standards as they pertain to road construction.

Land Use Controls

Land use regulations are an important tool in that they regulate future land development and minimize undesirable development along roads and highways. The land use regulatory system can improve highway safety by requiring sufficient setbacks to provide for adequate sight distances and by requiring off- street parking.

Development Reviews

Driveway access to a state-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation. In addition, any development expected to generate large volumes of traffic such as shopping

centers, fast food restaurants, or large industries may be comprehensively studied by staff from the Traffic Engineering Branch, Planning and Environmental Branch, and/or Roadway Design Unit of the NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility while preserving the integrity of the thoroughfare plan.

Funding Sources

Capital Improvements Program

A capital improvement program makes it easier to build a planned thoroughfare system. A capital improvement program consists of two lists of projects. The first is a list of highway projects that are designated as a municipalities responsibility and are to be implemented with municipal funds. The second is a list of local projects designated as State responsibility to be included in the Transportation Improvement Program.

Transportation Improvement Program

North Carolina's Transportation Improvement Program (TIP) is a document which lists all major construction projects the Department of Transportation plans for the next seven years. Similar to local Capital Improvement Program projects, TIP projects are matched with projected funding sources. Each year when the TIP is updated, completed projects are removed, programmed projects are advanced, and new projects are added.

During annual TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation member reviews all of the project requests in a particular area of the state. Based on the technical feasibility, need, and available funding, the board member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are available for bridge replacement projects, highway safety projects, public transit projects, railroad projects, and bicycle projects. See Appendix B for the proper procedure concerning the acquisition of TIP funds and for a project's inclusion in the TIP.

Industrial Access Funds

If an industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

Small Urban Funds

Small Urban funds are annual discretionary funds made to municipalities with qualifying projects. The maximum amount is $150,000 per year per project. A town may have multiple projects. Requests for Small Urban Fund assistance should be directed to the appropriate Board of Transportation member and Division Engineer.

The North Carolina Highway Trust Fund Law

The Highway Trust Fund Law was established in 1989 as a plan with four major goals for North Carolina's roads and highways. These goals are:

1. To complete the remaining 2,768 km (1,716 mi.) of four lane construction on the 5,800 km (3,600 mi.) North Carolina Intrastate System.

2. To construct a multilane connector in Asheville and portions of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.

3. To supplement the secondary roads appropriation in order to pave, by 1999, 16,100 km (10,000 mi.) of unpaved secondary roads carrying 50 or more vehicles per day, and all other unpaved secondary roads by 2006.

4. To supplement the Powell Bill Program.

In this 24-year planning period, Boiling Springs should look forward to the paving of most, if not all, of its unpaved roads on the State maintained system in the Planning Area.

For more information on the Highway Trust Fund Law, contact the Program Development Branch of the North Carolina Department of Transportation.

Implementation Recommendations

The following table provides a break down of the projects recommended in the Town of Boiling Springs Thoroughfare Plan and the corresponding method that would best suit the implementation of the given project. Appendix B gives an example of the proper procedure for the acquisition of TIP funds and for a project's inclusion in the TIP.

Table 1

Funding Sources and Methods Recommended for Implementation of Projects

	Funding Sources				Methods of Implementation				
Project	Local Funds	TIP Funds	Secondary Road Fund	Small Urban	T-fare Plan	Subdiv. Ord.	Zoning Ord.	Future Streets Lines	Development Review
Eastern Bypass Patrick Avenue		X			X	X	X	X	X
Western Bypass Homestead Avenue		X			X	X	X	X	X
Hillcrest St. Ext.	X				X	X	X		
Stadium Dr. Ext.	X				X	X	X		

Construction Priorities and Cost Estimates

Construction priorities will vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes would be more important than minor thoroughfares where traffic volumes are lower. To be in the North Carolina Transportation Improvement Program, a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment.

Reduced road user cost should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facilities have been made in terms of vehicle operating costs, travel time costs, and accident costs. These user benefits are computed as total dollar savings over the 24 year design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is shown as the probability that it will stimulate the economic development of an area by providing access to developable land and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability is rated on a scale from 0 (none) to 1.00 (excellent).

The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Below are listed the thirteen items that are considered when evaluating the impacts on the environment.

* air quality
* water resources
* soils and geology
* wildlife
* vegetation
* neighborhoods
* noise
* educational facilities
* churches
* parks and recreational facilities
* historic sites and landmarks
* public health and safety
* aesthetics

The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impacts of a project.

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. Table 3 shows the estimated cost of the major projects in the plan. The highway costs estimated in this report are based on the average statewide construction costs for similar project types. An estimate of anticipated right- of-way costs is also included. Table 4 evaluates the proposed Boiling Springs projects with respect to user benefits, estimated costs, probability of economic development, and environmental impact. Table 2 may be used as a guideline for interpreting the "Probable Impact" values in Table 4.

Table 2

Probability Estimation Guide

Subjective Evaluation	Impact Probability
Excellent - very substantial	1.00
Very Good - substantial	0.75
Good - considerable	0.50
Fair - some	0.25
Poor - none	0.00

Table 3

Potential Project Cost Estimates for Major Projects

Description	Construction	Right-of-Way	Total Cost
West College	$ 2,124,000	$ 28,000	$2,152,000
S Main St.	$ 463,500	$ 58,500	$ 522,000
E College Avenue	$ 5,144,000	$ 127,000	$5,271,000
Eastern Bypass	$ 4,001,000	$ 205,000	$4,206,000
Long Range Bypass	$ 3,944,000	$ 144,000	$4,088,000
East Homestead	$ 1,543,000	$ 36000	$1,579,000
West Homestead	$ 1,184,000	$ 27,000	$1,211,000
Skinner Road	$ 3,042,000	$ 70,000	$3,112,000
Cliffside Road	$ 1,173,000	$ 90,000	$1,263,000

Table 4

Benefits Evaluation for Major Projects and Probable Impacts

Project	Benefits (Millions)	Cost (Millions)	Length (Miles)	Benefits per Mile	Environmental Impact	Economic Development Potential
Eastern Bypass	56.89	4.21	2.56	22.22	+0.25/-0.00	0.50
Long Range Bypass	89.6	4.09	2.20	40.7	+0.20/-0.50	0.75
E. College Ave	5.15	5.27	1.74	2.96	+0.25/-0.25	0.75

Chapter 4

TRAVEL DEFICIENCY ANALYSIS OF EXISTING SYSTEM

This chapter presents an analysis of the ability of the existing street system to serve the area's travel desires. Emphasis is placed not only on detecting the deficiencies, but on understanding their cause. Travel deficiencies may be localized and the result of substandard highway design, inadequate pavement width, or intersection controls. Alternately, the underlying problem may be caused by a system deficiency such as a need for a bypass, loop facility, construction of missing links, or additional radials.

Existing Travel Patterns

An indication of the adequacy of the existing street system is a comparison of traffic volumes versus the ability of the streets to move traffic. In an urban area, a street's ability to move traffic is generally controlled by the spacing of major intersections, access control, width of pavement, and the utilization of traffic control devices such as signals.

Capacity represents the maximum number of vehicles that pass a given point during a specified period under prevailing roadway, traffic, and control conditions. The relationship of traffic volumes to the capacity of the roadway will determine the **level of service (LOS).** Six levels of service identify the range of possible conditions. Figure 4 shows the levels of congestion associated with the various levels of service. Table 5 gives a brief description of each LOS in accordance with the 1994 Highway Capacity Manual.

Design requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each road or highway section must be individually analyzed and its design requirements determined by the amount and type of projected traffic, existing capacity, desired level of service, and available right of way. The recommended improvements and overall design of the Thoroughfare Plan were based on achieving a minimum of LOS D on existing facilities, and LOS C on new facilities. LOS D is considered the **"practical capacity"** of a facility, or that at which the public begins to express dissatisfaction.

Table 5

Level of Service

LOS A - Describes primarily free flow-operations at average travel speeds usually about 90 percent of the free-flow speed for the arterial class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at signalized intersections is minimal.

LOS B - Represents reasonable unimpeded operations at average travel speeds usually about 70 percent of the free-flow speed for the arterial class. The ability to maneuver within the traffic stream is only slightly restricted and stopped delays are not bothersome. Drivers are not generally subjected to appreciable tension.

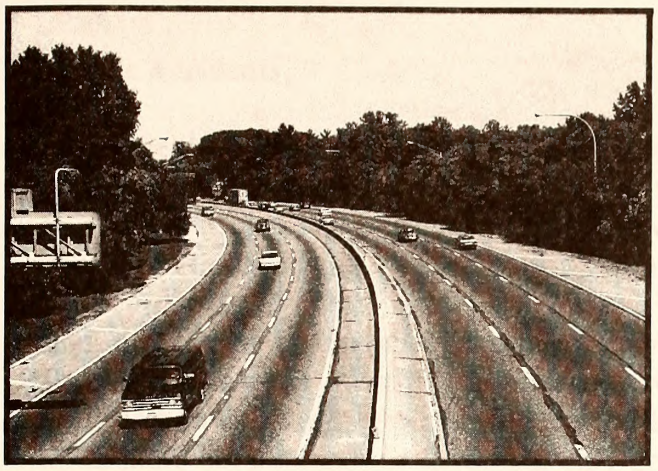
LOS C - Represents stable operations. However, ability to maneuver and change lanes in mid-block locations may be more restricted than in LOS B, and longer queues and/or adverse signal coordination may contribute to lower average travel speeds of about 50 percent of the average free-flow speed for the arterial class. Motorists will experience an appreciable tension while driving.

LOS D - Borders on a range on which small increases in flow may cause substantial increases in approach delay and, hence, decreases in arterial speed. Delay may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free-flow speed.

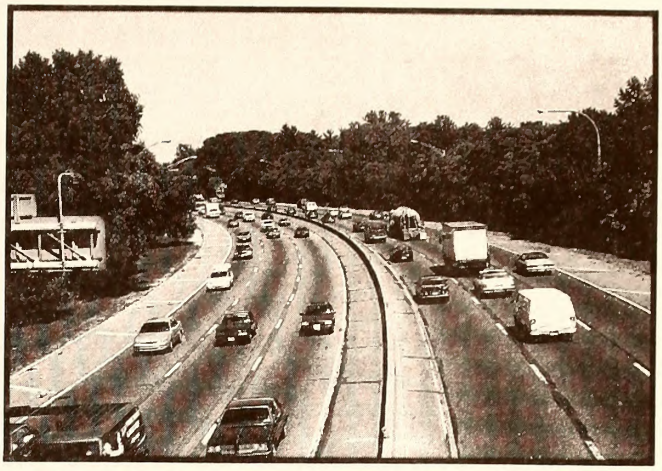
LOS E - The boundary between LOS D and LOS E describes operation at **capacity.** Operations at this level are extremely unstable, because there are virtually no gaps in the traffic stream. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or changing lanes, requires the following vehicles to give way to admit the vehicle. This condition establishes a disruption wave which propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate any disruption. Any incident can be expected to produce a serious breakdown with extensive queuing.

LOS F - Describes forced or breakdown flow. The arterial flow is at extremely low speeds - below one-third to one-quarter of the free-flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse progression is frequently a contributor to this condition.

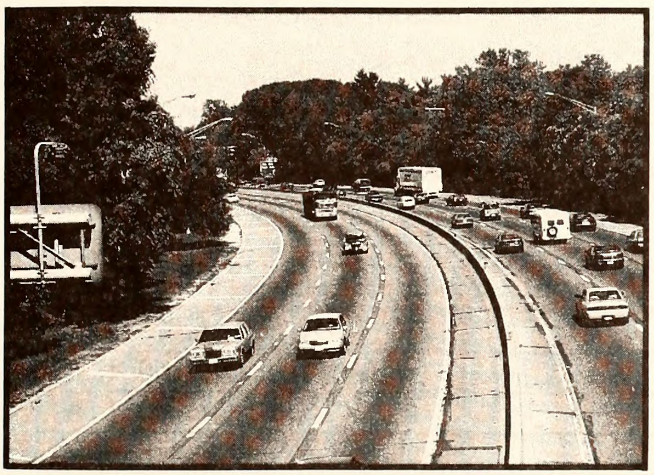
Source: 1994 Highway Capacity Manual



LOS A.

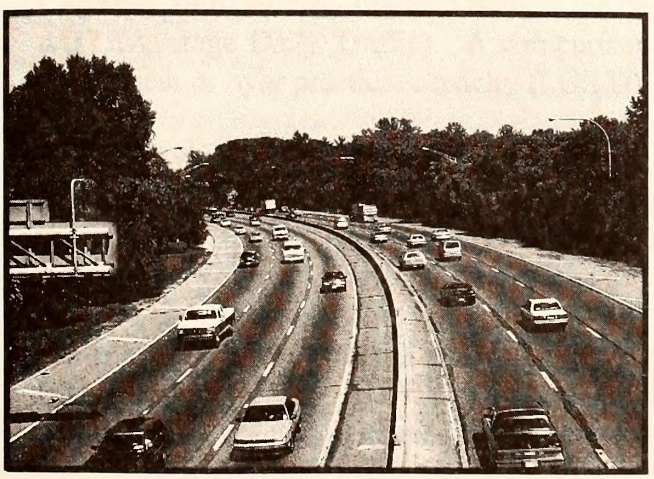


LOS D.



LOS B.

LOS E.



LOS C.

LOS F.

LEVELS OF SERVICE

FIGURE 4

Traffic Accidents

High Accident Locations - Traffic accident records are of assistance in defining problem areas and pinpointing a transportation deficiency such as poor design, inadequate signing, ineffective parking, or poor sight distance. Accident patterns developed from analysis of accident data can lead to remedial action reducing the number of accidents.

Both the severity and number of accidents should be considered when investigating accident data. The severity of every accident is measured with a series of weighted factors developed by the NCDOT's Division of Highways. In terms of these factors, a fatal or incapacitating accident is 47.7 times more severe than one involving only property damage, and an accident resulting in minor injury is 11.8 times more severe than one with only property damage. Table 6 is a summary of accidents in the Town of Boiling Springs planning area from January 1, 1992 to December 31, 1994. The "Total" column indicates the total number of accidents reported within two hundred (200) feet of the intersection during the indicated time period. The severity listed is the average accident severity for that location.

Table 6

Accident Summary for Boiling Springs
(From 01/01/92 to 12/31/94)

Location	Total	Severity
College and Main St.	20	3.22
NC 150 and Patrick Avenue	6	4.70
NC 150 and SR 1159	6	4.70
Main St. and Patrick Avenue	6	4.70

1994 Traffic Capacity Analysis

Capacity Deficiencies- Figure 5 depicts the base year (1994) major street system, and the base year **ADT** (Average Daily Traffic). A comparison of the base year ADT to capacities reveals several streets near or over practical capacity (LOS D). These areas include:

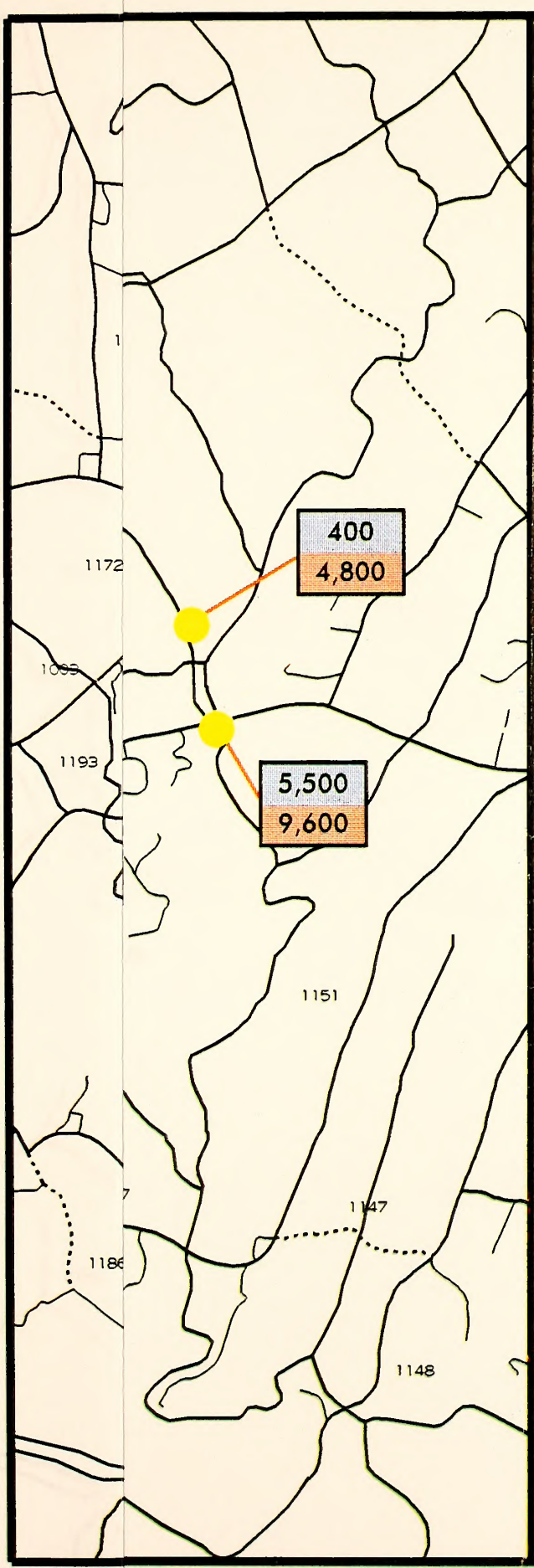
College Avenue- From Patrick Avenue to W. Homestead Avenue is currently near capacity. The capacity on this section is 9,600 vpd (vehicles per day). Currently approximately 6,000 vpd are using this section of roadway. By the year 2020, if no improvements are made to the existing system, this volume is expected to increase to 11,500 vpd.

Main Street- Main Street is a north-south facility that runs thorough the center of town. It has a capacity of 9,600 vpd. In 1994 the average daily traffic volume was 6,500 vpd. By the year 2020, volumes are expected to increase to 11,100 vpd.

No Build Alternative- Not implementing a thoroughfare plan or elements of it could be called a No-Build Alternative. This means that there would be no new construction or roadway improvements to the Boiling Springs thoroughfare system except for routine maintenance. If no improvements are made the increased traffic volumes and normal growth will result in a dramatic reduction in transportation quality.

The LOS on Main Street and College Avenue will drop to LOS E. At LOS E the operating speed will drop significantly, and the queues of traffic currently experienced behind slow moving vehicles will get considerably longer. The absence of improvements will negatively impact growth and business in the Boiling Springs area.

Figure 6 shows the existing street system with the 2020 volumes assuming that no improvements are made by the design year.



EXISTING STREET SYSTEM WITH 1994 ADT'S

LEGEND

Base Year ADT

Capacity

0000
0000

BOILING SPRINGS

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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers

0 1000 2000 3000 4000
feet

Figure 5

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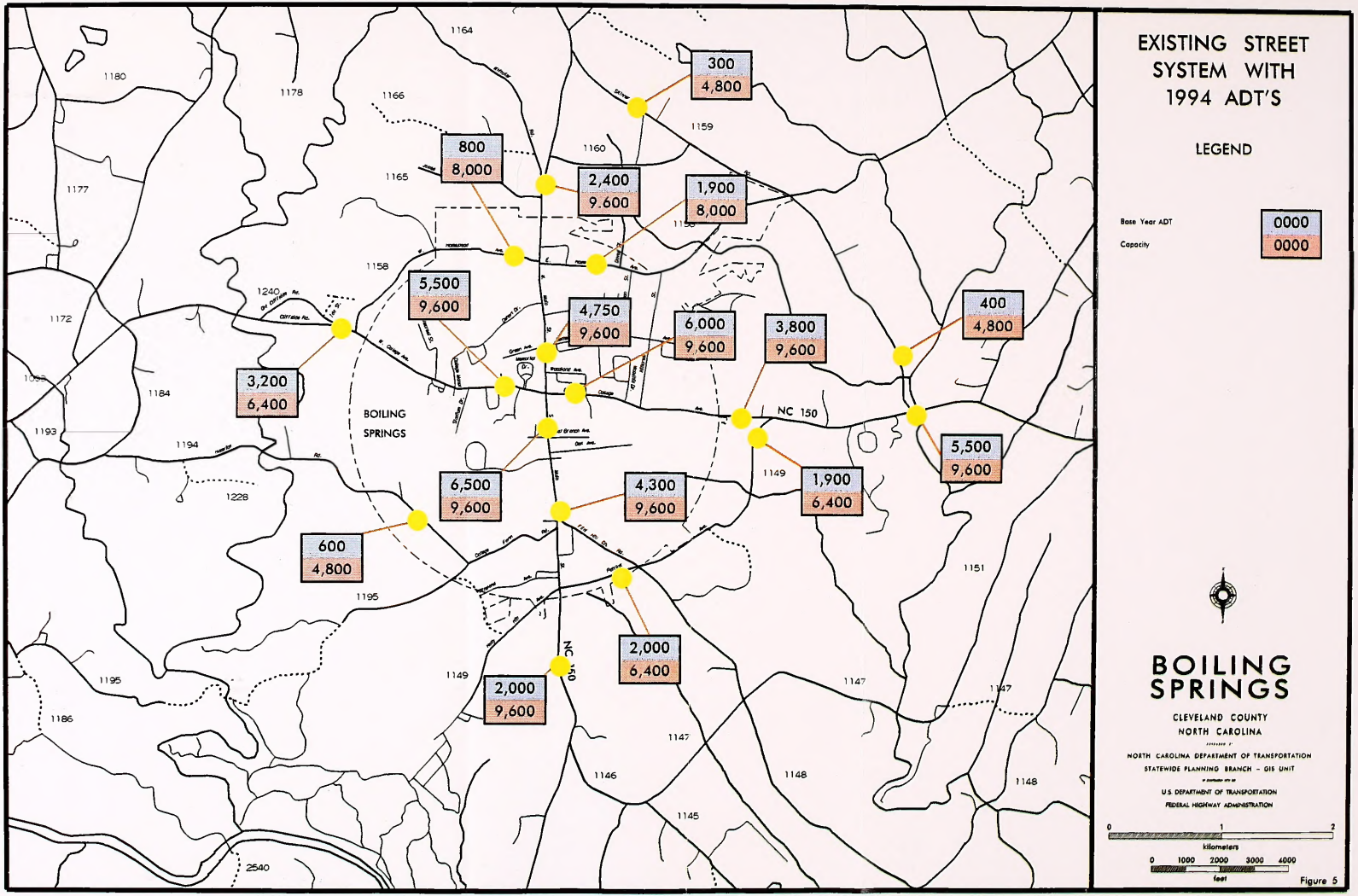
EXISTING STREET SYSTEM WITH 1994 ADT'S
LEGEND
Base Year ADT
Capacity
0000
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BOILING SPRINGS
CLEVELAND COUNTY
NORTH CAROLINA
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
0 1 2
kilometers
0 1000 2000 3000 4000
feet
300
4,800
800
8,000
2,400
9,600
1,900
8,000
5,500
9,600
4,750
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6,000
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BOILING SPRINGS
NC 150
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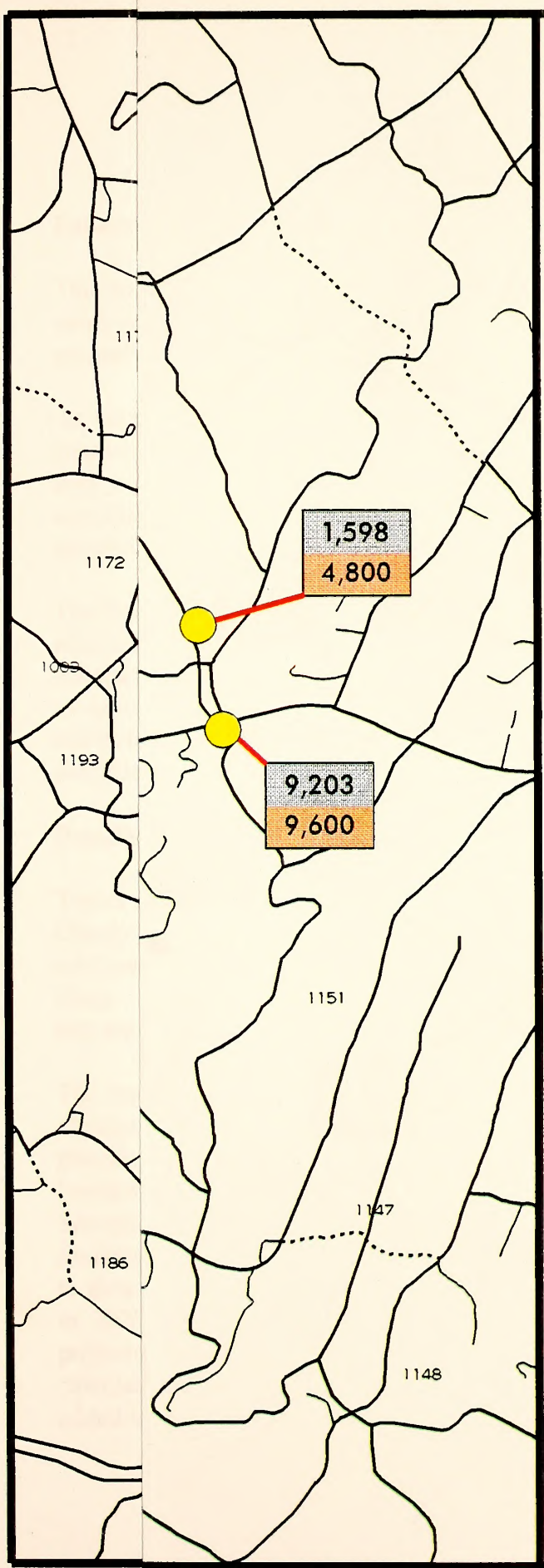
Figure 5



EXISTING STREET SYSTEM WITH 2020 ADT'S

LEGEND

2020 ADT
Capacity

0000
0000

FIGURE 6

N

BOILING SPRINGS

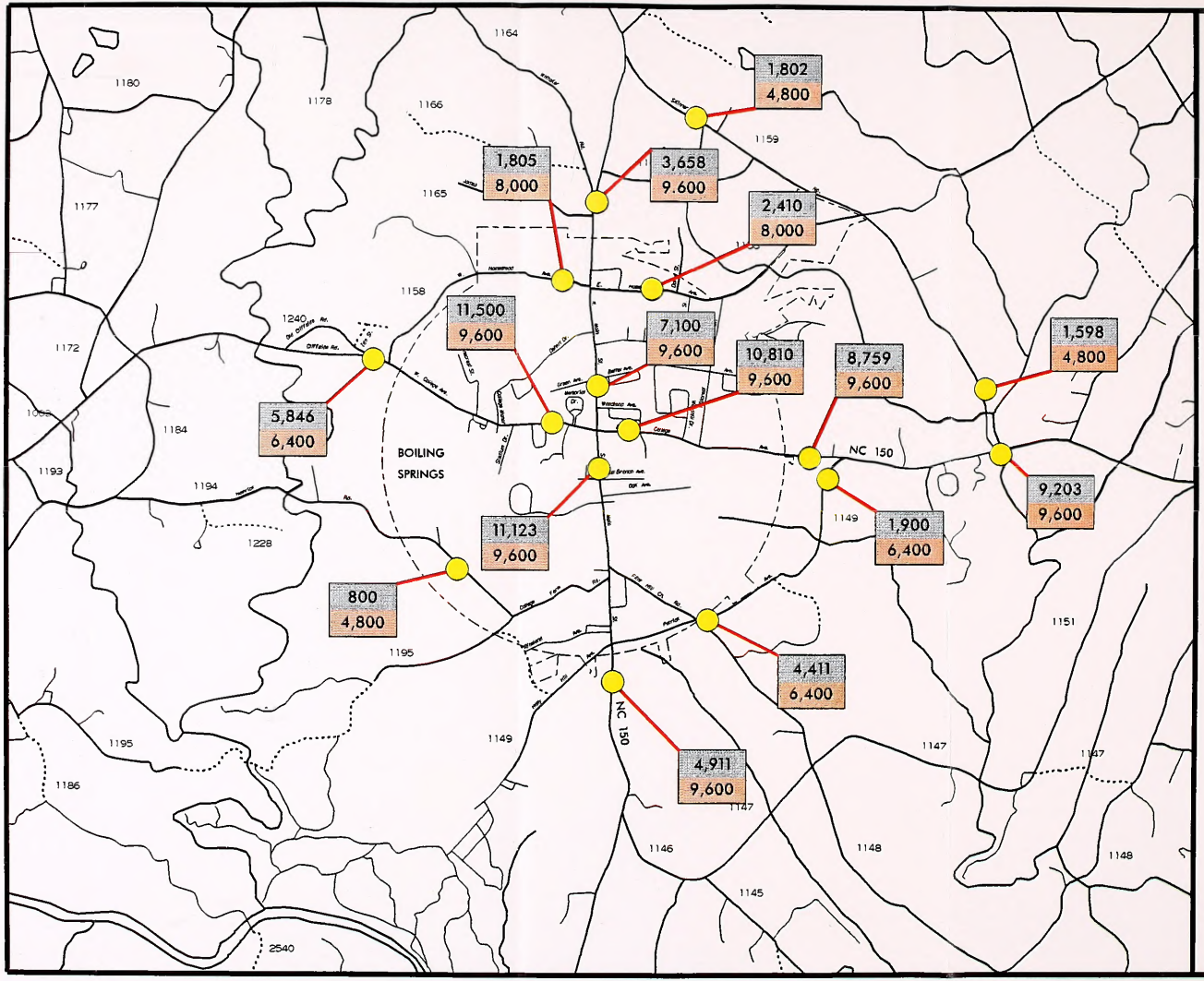
CLEVELAND COUNTY
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT

IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers

0 1000 2000 3000 4000
feet



EXISTING STREET SYSTEM WITH 2020 ADT'S

LEGEND

2020 ADT 0000
Capacity 0000

FIGURE 6

BOILING SPRINGS

CLEVELAND COUNTY
NORTH CAROLINA

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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers
0 1000 2000 3000 4000
feet

Chapter 5

POPULATION, LAND USE, AND TRAFFIC

Factors Affecting Transportation

The factors of population, land use and traffic play a vital role in determining the transportation needs of a city. Examination of these factors helps to explain historic travel patterns and lays the groundwork for thoroughfare planning.

In order to formulate an adequate year 2020 thoroughfare plan, reliable forecasts of future travel characteristics must be achieved. The factors of population, vehicle usage trends, economy and land use play a significant role in determining the transportation needs of the area, and must be carefully analyzed. Additional items may include the effects of legal controls such as subdivision regulations and zoning ordinances, availability of public utilities and physical features of the area.

The first step in the development of the thoroughfare plan is to define the planning period and the planning area. The base year for the Boiling Springs study was 1994, and the year 2020 was chosen to be the end point of the study period (26 years). The planning area is generally the limits to which urbanization is expected to occur during the planning period. The planning area is then subdivided into traffic analysis zones. Figure 7 shows the planning area boundary and traffic analysis zones.

Population

Travel is directly related to population. The volume of traffic on any given section of roadway is closely related to the size and distribution of the population which it serves. Because of this relationship, one of the basic steps in planning a transportation system is an in-depth population study. Population trends for Boiling Springs and Cleveland County are shown in Table 7 and 8, and are graphically illustrated in Figure 8.

The most important population estimate for development of the thoroughfare plan is that of the planning area. Even though government census data is not available for the transportation planning area, other methods of estimation of population are available. The 1994 housing "windshield" survey for this study area gave a final count of 212 homes outside the Boiling Springs Corporate limits. The housing count was then multiplied by the average persons per dwelling unit for Boiling Springs (2.47) and added to the 1994 Boiling Springs population (2531) to give a total planning area population of 3054. The Town's population was projected to be 3727 in 2020. The number of houses outside the city limit and inside the planning boundary is projected to increase to 392 houses. Future year population of the Planning Boundary was then calculated by multiplying projected average persons per dwelling unit (2.22) by 392 houses and added to the Town's projected population of 3727 to achieve a 2020 population of 4597.

Table 7

Population Trends and Projections

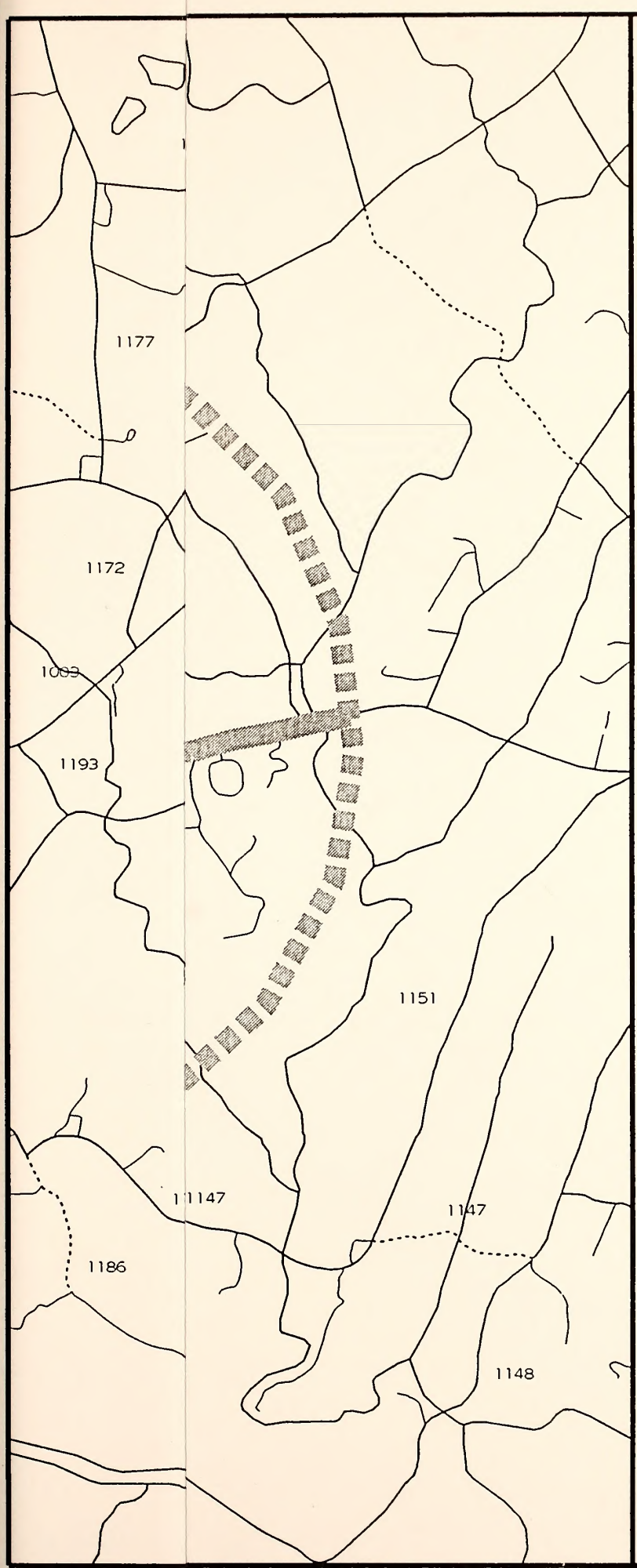
Year	Boiling Springs	Cleveland Co.	BS Township
1940	613	58,055	2,925
1950	1,145	64,357	3,876
1960	1,311	66,048	3,822
1970	2,284	72,556	5,193
1980	2,381	83,435	5,773
1990	2,445	84,713	6,060
2000	2,980b / 1000d	89,916a	6,520c
2010	3333b / 1160d	89,208a	6,467c
2020	3,727b / 1347d	87,737a	6,361c

a Estimate by Office of State Budget and Management
b Projection based on past trends
c Estimation of County Population x Township% of County
d This number is the estimated student on campus population for Gardner-Webb University. This number should be added onto the general population of Boiling Springs.

Table 8

Population Projections for the Boiling Springs Planning Area

Year	Planning Area Population
1994	3054
2020	4597



ZONE MAP

LEGEND

PLANNING BOUNDARY

ZONE BOUNDARY

BOILING SPRINGS

CLEVELAND COUNTY
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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers

0 1000 2000 3000 4000
feet

FIGURE 7

Table 7

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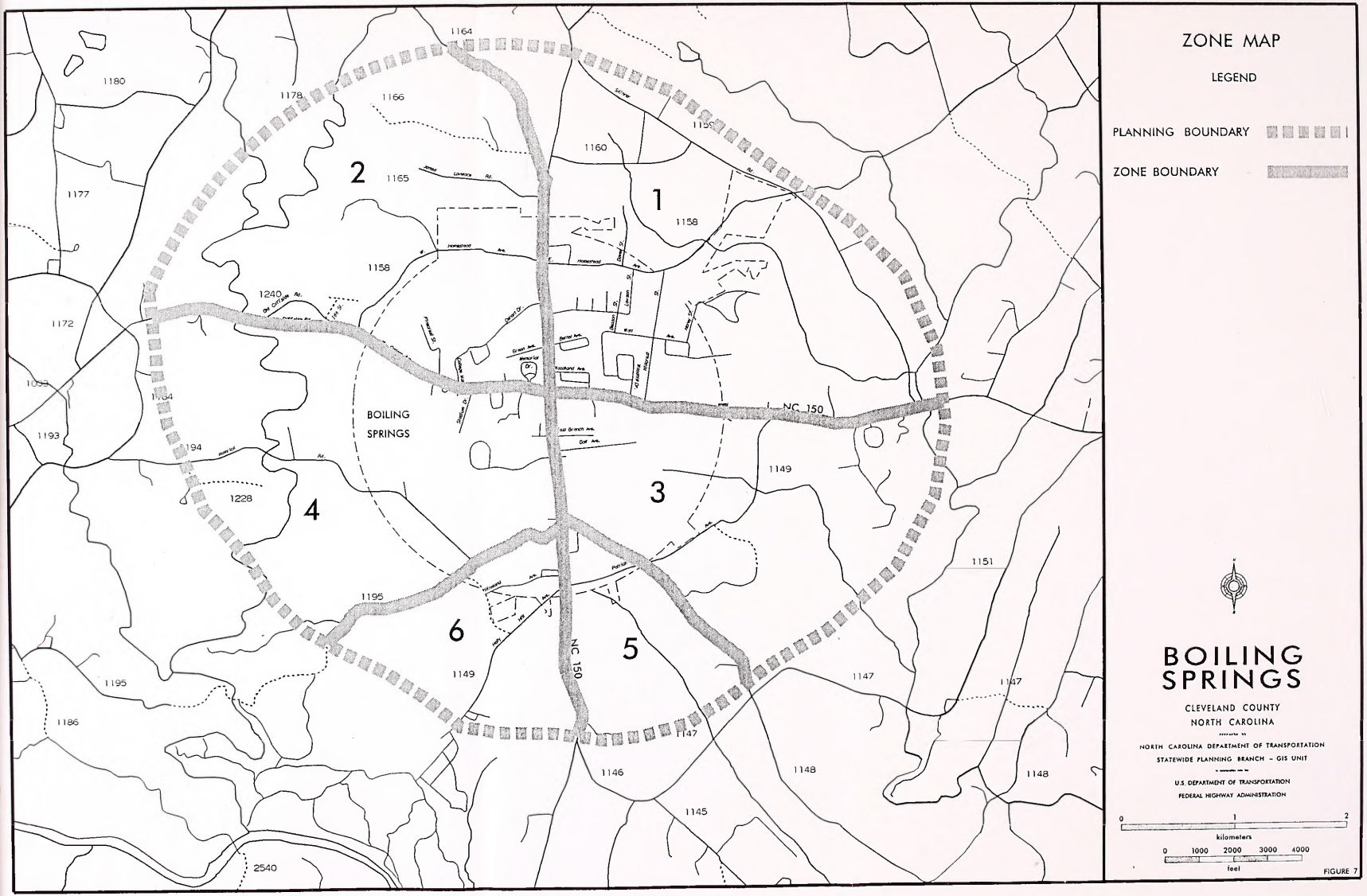
ZONE MAP
LEGEND
PLANNING BOUNDARY
ZONE BOUNDARY
BOILING SPRINGS
CLEVELAND COUNTY
NORTH CAROLINA
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
0 1 2
kilometers
0 1000 2000 3000 4000
feet
FIGURE 7
BOILING SPRINGS
NC 150
1
2
3
4
5
6
1164
1180
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1166
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1158
1177
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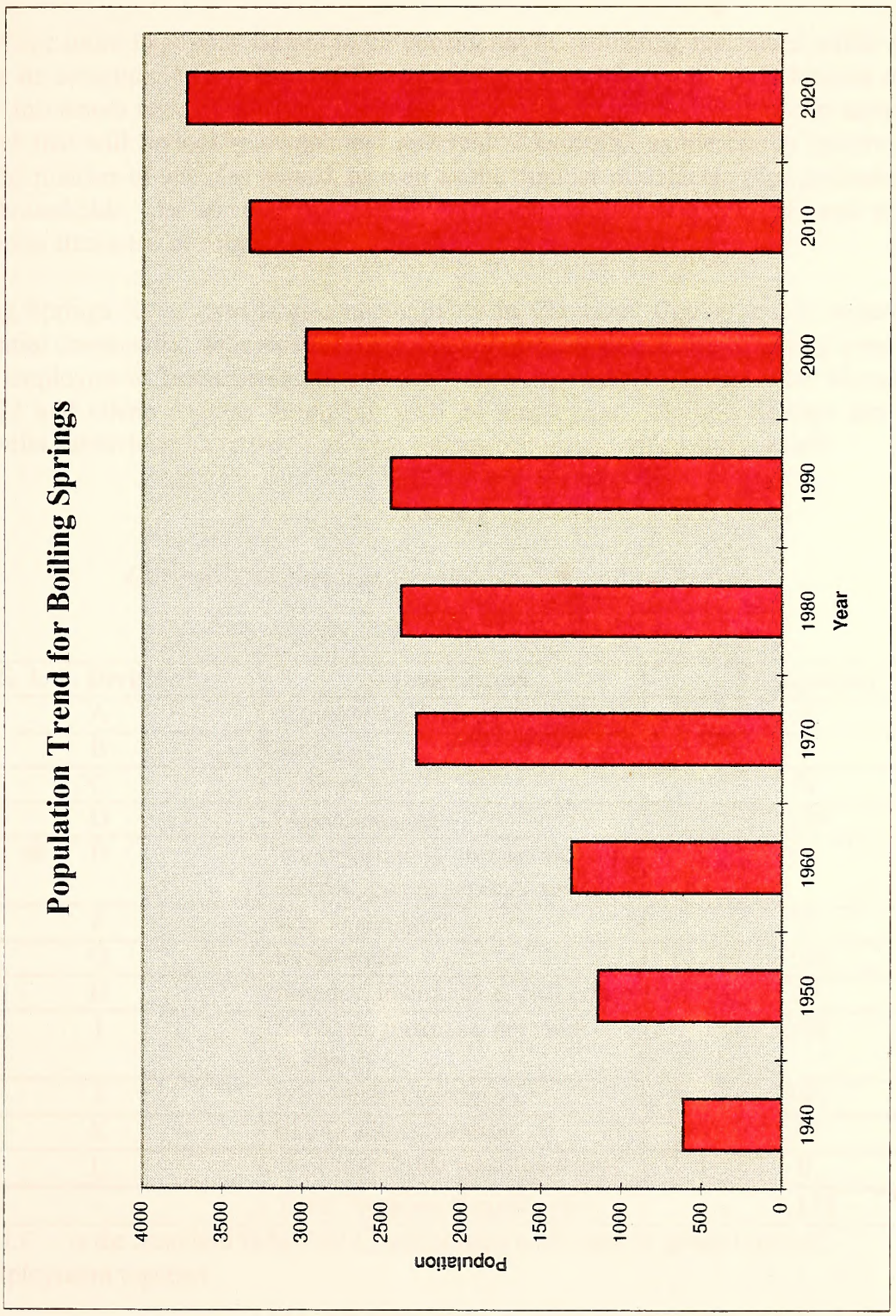
Figure 8


Population Trend for Boiling Springs
Population
0
500
1000
1500
2000
2500
3000
3500
4000
1940
1950
1960
1970
1980
1990
2000
2010
2020
Year

Economy and Employment

One of the more important factors to be considered in estimating the future traffic growth of an area is its economic base. The number of employers and the employee's income or purchasing power influences how much population can be supported in the area and the number of motor vehicles that will be locally owned and operated. Generally, as the family income increases so does the number of vehicles owned, as well as the number of vehicles trips generated per day by each household. An accurate projection of the future economy of the area is essential to estimating future travel demand.

Boiling Springs is the third largest municipality in Cleveland County and it is predominantly a residential community, with most of the residents working outside the planning area. Some of the major employers in Town are Gardner-Webb University with 436, the Crawley Memorial Hospital with 72 and Glenn Lumber Company with 34 employees. Boiling Springs has several new residential subdivisions as a result of large estates being subdivided and sold off.

Table 9

Current Employment Breakdown for Boiling Springs

S. I. C. Division*	Description	# Employed
A	Agriculture, forestry & fishing	5
B	Mining	0
C	Construction	52
D	Manufacturing	339
E	Transportation, communication, electric, gas & sanitary services	36
F	Wholesale trade	12
G	Retail trade	154
H	Finance, insurance & real estate	29
I	Services, business, personal & health	196
J	Educational services	303
K	Public administration	32
L	Nonclassifiable establishments	0
	Total Number Employed =	1,158

* S.I.C. - is the Standard Industrial Classification code used to group types of employment together

Land Use

Land use refers to the physical patterns of activities and functions within the city. Nearly all traffic problems in a specific area are relative to the area's land use. The amount of traffic on a particular street is very closely related to its adjacent land use. For example, a large industrial plant might be the cause of congestion during shift change hours as its workers come and go. However, during the remainder of the day, few problems if any, may occur. The spatial distribution of different types of land use (sometimes referred to as traffic generators) is the predominant determinant of when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies depending on the size, type, intensity, and spatial separation of each.

For use in transportation planning, land uses are grouped into four categories:

1. **Residential** - all land devoted to the housing of people except hotels and motels
2. **Commercial** - all land devoted to retail trade including consumer, business services and offices
3. **Industrial** - all land devoted to manufacturing, storage, warehousing, and transportation of products
4. **Public** - all land devoted to social, religious, educational, cultural, and political activities.

Figure 9 shows the planning area's existing land use.

Anticipated future land use is a logical extension of the present spatial distribution. Determination of where expected growth is to occur within the planning area facilitates the location of proposed thoroughfares. Areas of anticipated development and growth for Boiling Springs are:

Residential - A large amount of residential land development is located in the northeastern and northwestern portion of the Town of Boiling Springs. The potential for new residential development remains in the northern section of the planning area.

Commercial/Retail - Most of the commercial development, in Boiling Springs is on Main Street and on E. College Avenue. Future growth is projected to happen in the same areas especially along NC 150 E. toward Shelby.

Manufacturing - The only manufacturing plants in the planning area are Glenn Lumber Company with 34 employees on Rockford Road and Wellington Hamrick septic tank company with 12 employees on West College Street. There is no other development expected at this time.

Public - The largest public institution in Boiling Springs is Gardner-Webb University, this college has had a significant affect on the character and quality of life in Boiling Springs.

Downtown Boiling Springs, has experienced a great deal of growth. Due to the number of businesses in this area and the Gardner-Webb University, traffic volume has increased significantly. The implementation of the thoroughfare plan and the proposed eastern and western bypass will encourage development on other portions of the town.

Travel Demand

Travel demand is generally reported in average daily traffic counts. Traffic counts are taken regularly in and around Boiling Springs by the North Carolina Department of Transportation. To estimate future travel demand, traffic trends over the past twenty years were studied. A comparison of annual growth rates from 1970 to 1994 at various count locations in Boiling Springs shows the average annual growth rates ranging from 0.05% to 3.5%. The largest growth was noted on W. Homestead Avenue of 3.5% to 4.0%. All major thoroughfares have experienced a growth rate of 2.5% to 3.0%. Increase in residential and commercial developments in the planning area will cause increases in traffic growth in those immediate areas. Eventually, this increase will level off and follow the growth pattern of the surrounding area.

LAND USE MAP

Legend

- County Boundary or Township Line
- Municipal Boundaries
- Major Roadways
- Local Roads
- Rail Lines
- Rivers and Streams
- Expanding Commercial / Industrial
- Expanding Residential
- Agricultural / Rural
- Greenways / Open Space / Parks
- Gateways
- New Thoroughfares
- Existing Water Service Area
- Water Line Extension
- Existing Sewer Service Area
- Sewer Line Extension
- Existing Water and Sewer Service Area

BOILING SPRINGS

CLEVELAND COUNTY
NORTH CAROLINA

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FEDERAL HIGHWAY ADMINISTRATION

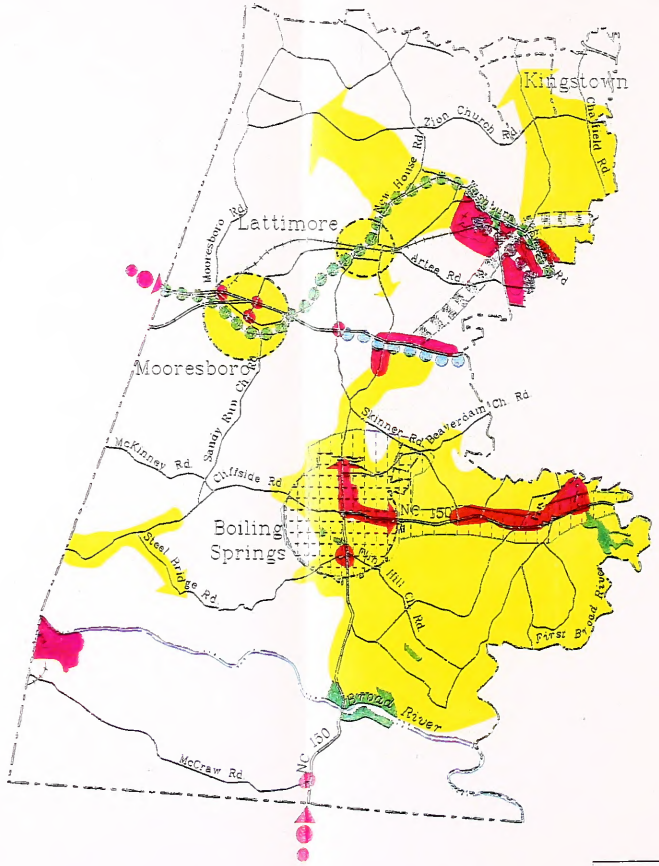
0 1 2
kilometers

0 1000 2000 3000 4000
feet

20,000

1 0 1 2 3 4 5 MILES

FIGURE 9



Scale 1 : 120,000

MILES

LAND USE MAP

Legend

- County Boundary or Township Line
- Municipal Boundaries
- Major Roadways
- Local Roads
- Rail Lines
- Rivers and Streams
- Expanding Commercial / Industrial
- Expanding Residential
- Agricultural / Rural
- Greenways / Open Space / Parks
- Gateways
- New Thoroughfares
- Existing Water Service Area
- Water Line Extension
- Existing Sewer Service Area
- Sewer Line Extension
- Existing Water and Sewer Service Area

BOILING SPRINGS

CLEVELAND COUNTY
NORTH CAROLINA

prepared by

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT

in cooperation with

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers

0 1000 2000 3000 4000
feet

FIGURE 9

Chapter 6

ENVIRONMENTAL CONCERNS

In the past several years, environmental considerations associated with highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act. Section 102 of this act requires the execution of an environmental impact statement, or EIS, for road projects that have a significant impact on the environment. Included in an EIS would be the project's impact on wetlands, water quality, historic properties, wildlife, and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several of these factors and is included below.

Wetlands

In general terms, wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrata that is at least periodically saturated with or covered by water. Water creates severe physiological problems for all plants and animals except those that are adapted for life in it or in saturated soil.

Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes, and streams by slowly storing and releasing flood waters. They help maintain the quality of our water by storing nutrients, reducing sediment loads, and reducing erosion. They are also critical to fish and wildlife populations. Wetlands provide an important habitat for about one third of the plant and animal species that are federally listed as threatened or endangered.

In this study, the impacts to wetland were determined using the National Wetlands Inventory Mapping, available from the U. S. Fish and Wildlife Service. The location of wetlands throughout Boiling Springs are shown in Figure 10.

Wetland impacts have been avoided or minimized to the greatest extent possible while preserving the integrity of the transportation plan.

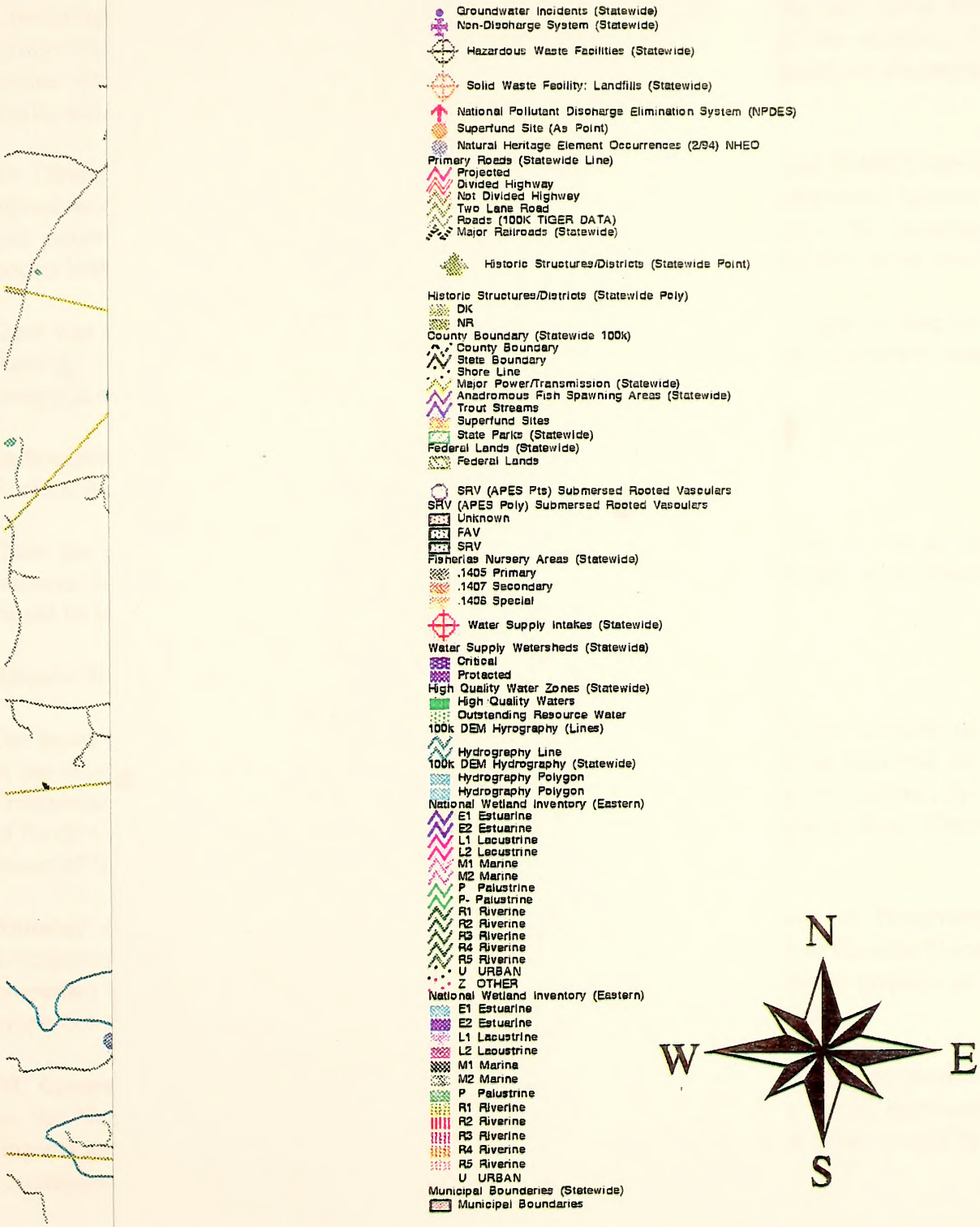
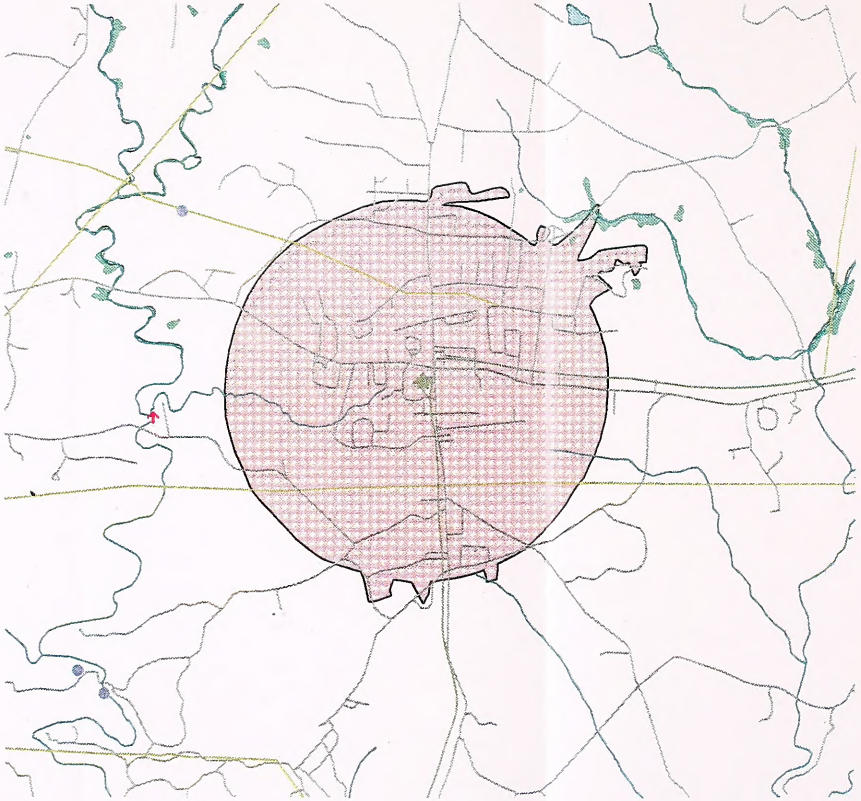

Groundwater Incidents (Statewide)
Non-Discharge System (Statewide)
Hazardous Waste Facilities (Statewide)
Solid Waste Facility: Landfills (Statewide)
National Pollutant Discharge Elimination System (NPDES)
Superfund Site (As Point)
Natural Heritage Element Occurrences (2/94) NHEO
Primary Roads (Statewide Line)
Projected
Divided Highway
Not Divided Highway
Two Lane Road
Roads (100K TIGER DATA)
Major Railroads (Statewide)
Historic Structures/Districts (Statewide Point)
Historic Structures/Districts (Statewide Poly)
DK
NR
County Boundary (Statewide 100k)
County Boundary
State Boundary
Shore Line
Major Power/Transmission (Statewide)
Anadromous Fish Spawning Areas (Statewide)
Trout Streams
Superfund Sites
State Parks (Statewide)
Federal Lands (Statewide)
Federal Lands
SRV (APES Pts) Submersed Rooted Vasculars
SRV (APES Poly) Submersed Rooted Vasculars
Unknown
FAV
SRV
Fisheries Nursery Areas (Statewide)
.1405 Primary
.1407 Secondary
.1406 Special
Water Supply Intakes (Statewide)
Water Supply Watersheds (Statewide)
Critical
Protected
High Quality Water Zones (Statewide)
High Quality Waters
Outstanding Resource Water
100k DEM Hyrography (Lines)
Hydrography Line
100k DEM Hydrography (Statewide)
Hydrography Polygon
Hydrography Polygon
National Wetland Inventory (Eastern)
E1 Estuarine
E2 Estuarine
L1 Lacustrine
L2 Lacustrine
M1 Marine
M2 Marine
P Palustrine
P- Palustrine
R1 Riverine
R2 Riverine
R3 Riverine
R4 Riverine
R5 Riverine
U URBAN
Z OTHER
National Wetland Inventory (Eastern)
E1 Estuarine
E2 Estuarine
L1 Lacustrine
L2 Lacustrine
M1 Marine
M2 Marine
P Palustrine
R1 Riverine
R2 Riverine
R3 Riverine
R4 Riverine
R5 Riverine
U URBAN
Municipal Bounderies (Statewide)
Municipal Boundaries
N
W
E
S
1.8
3.6 Miles

FIGURE 10

Environmental Data for Boiling Springs



1.8 0 1.8 3.6 Miles

Groundwater Incidents (Statewide)
Non-Discharge System (Statewide)
Hazardous Waste Facilities (Statewide)
Solid Waste Facility: Landfills (Statewide)
National Pollutant Discharge Elimination System (NPDES)
Superfund Site (As Point)
Natural Heritage Element Occurrences (2/94) NHEO
Primary Roads (Statewide Line)
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Not Divided Highway
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R3 Riverine
R4 Riverine
R5 Riverine
U URBAN
Z OTHER
National Wetland Inventory (Eastern)
E1 Estuarine
E2 Estuarine
L1 Lacustrine
L2 Lacustrine
M1 Marine
M2 Marine
P Palustrine
R1 Riverine
R2 Riverine
R3 Riverine
R4 Riverine
R5 Riverine
U URBAN
Municipal Boundaries (Statewide)
Municipal Boundaries

N
W E
S

FIGURE 10

Threatened and Endangered Species

A preliminary review of the Federally Listed Threatened and Endangered Species within Boiling Springs was done to determine the effects that new corridors could have on the wildlife. These species were identified using mapping from the North Carolina Department of Environment, Health, and Natural Resources.

The Threatened and Endangered Species Act of 1973 allows the U. S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we are able to avoid or minimize these impacts.

There was one federally listed threatened or endangered species identified in the Boiling Springs Planning Area. It is listed below. Detailed field investigation is recommended prior to construction of any highway project in this area.

Endangered:
Picoides Borealis (Red-Cockaded Woodpecker)

There are also several species in Boiling Springs that are significantly rare or are of special concerns in North Carolina. These species may become threatened or endangered in the future and should be looked at in subsequent planning studies.

Historic Sites

The location of historic sites in Boiling Springs was investigated to determine the possible impacts of the various projects studied. The federal government has issued guidelines requiring all State Transportation Departments to make special efforts to preserve historic sites. In addition, the State of North Carolina has issued its own guidelines for the preservation of historic sites. These two pieces of legislation are described below:

National Historic Preservation Act - Section 106 of this act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The DOT must consider the impact of its road projects on these properties and consult with Federal Advisory Council on Historic Preservation.

NC General Statute 121-12(a) - This statute requires the DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. DOT must consider impacts and consult with the North Carolina Historical Commission, but it is not bound by their recommendations.

Currently E.B. Hamrick Hall on the Gardner-Webb University Campus is the only property in the Boiling Springs planning area that is listed on the National Register of Historic Places. A closer study should be done in regard to the local historic sites prior to the construction of any proposal in order to preserve the natural settings of the area.

Archaeology

There are a few archaeological sites located around Boiling Springs, but most sites found nothing of significance. Most of these small sites have probably been destroyed over the years. However, care should be taken to make sure that any possible archaeological sites should be looked at closer prior to the construction of any proposals.

Chapter 7

THOROUGHFARE PLANNING PRINCIPLES

Objectives

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with the changing traffic patterns. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and it helps eliminate unnecessary improvements, so needless expense can be averted. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial and industrial development affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

- To provide for the development of an adequate major street system as land development occurs;
- To reduce travel and transportation costs;
- To reduce the cost of major street improvements to the public through the coordination of street system with private action;
- To enable private interests to plan their actions, improvements, and development with full knowledge of public intent;
- To minimize disruption and displacement of people and business through long range planning for major street improvements;
- To reduce environmental impacts such as air pollution, resulting from transportation; and
- To increase travel safety.

These objectives are achieved through improving both the operational efficiency of thoroughfares, and improving the system efficiency by system coordination and layout.

Operational Efficiency

The operational efficiency of a street is improved by increasing the capability of the street to carry vehicular traffic and people. In terms of vehicular traffic, the capacity of a street is the maximum number of vehicles that can pass a given point on a roadway during a given period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include:

Street widening - widening a street from two to four travel lanes, the capacity of the roadway more than doubles because additional maneuverability for the traffic has been provided.

Intersection improvements - increasing the turning radii, adding exclusive turn lanes, and channelizing movements can improve the capacity of an existing intersection.

Improving vertical and horizontal alignment - reduces the congestion caused by slow moving vehicles.

Eliminating roadside obstacles - reduces side friction and improves a driver's field of sight.

Operational ways to improve street capacity include:

Control of access - a roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number of lanes.

Parking removal - increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.

One-way operation - the capacity of a street can sometimes be increased 20-50%, depending upon turning movements and street width, by initiating one-way traffic operations. One-way streets also can improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

Reversible lanes - reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur at peak periods.

Signal phasing and coordination - uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

Carpools - encourage people to form carpools and vanpools for journeys to work and other trip purposes; this reduces the number of vehicles on the roadways and raises the people carrying capability of the street system.

Alternate mode - encourage the use of alternate modes of travel such as transit, bicycles, or walking for short distance trips.

Work hours - encourage industries, business, and institutions to stagger work hours or establish variable work for employees; this will reduce travel demand in peak periods and spread peak travel over a longer period.

System Efficiency

Thoroughfare Classification Systems

Streets perform two primary functions, traffic service and land access, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely developed abutting property lead to intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets that permit travel from origins and destinations with directness, ease and safety. Different streets in this system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict.

Local access streets have the primary purpose of providing access to abutting property. This classification may be further classified as either residential, commercial, and/or industrial depending upon the type of land use that they serve.

Minor Thoroughfares are more important streets on the city system. They collect traffic from local access streets and carry it to the major thoroughfare system. They may in some instances supplement the major thoroughfare system by facilitating minor through movements. A third function is to provide access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major thoroughfares are the primary traffic arteries of the city. Their function is to move intra-city and inter-city traffic. The streets which comprise the major thoroughfare system may also serve abutting property, however, their function is to carry traffic. They should not be bordered by uncontrolled strip development because this development significantly lowers the capacity of the thoroughfare. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to major expressways with four or more lanes of traffic. Parking normally should not be permitted on major thoroughfares.

Idealized Thoroughfare Plan System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desired lines of travel within an urban area and which permits movement between various areas of the city within maximum directness is the radial-loop system. This system consists of several elements – radial streets, crosstown streets, loop street systems and bypasses.

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

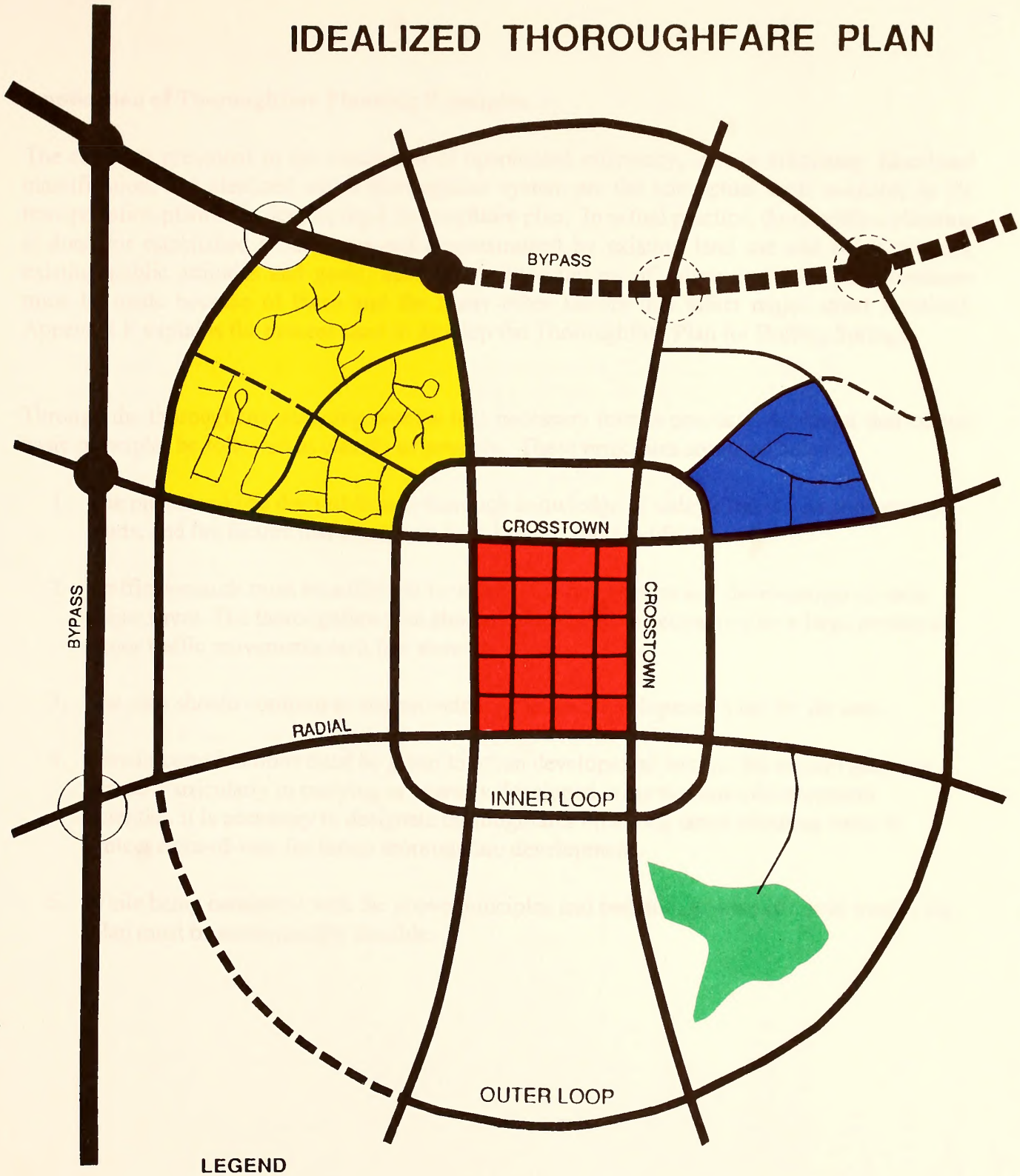
If all radial streets crossed in the central area, an intolerable congestion problem would occur. To avoid this problem, it is important to have a system of crosstown streets which form a loop around the central business district (CBD). This system allows traffic moving from origins on one side of the CBD to destinations on the other to follow the area's border and allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of through traffic, thus permitting the central area to function more adequately in its role as a pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the urban area's size, and they are generally ½ to one mile apart, depending upon the intensity of the landuse.

A bypass is designed to carry traffic around the urban area, thus providing relief to the city street system by removing from it traffic which has no desire to be in the city. Bypasses are usually designed with control of access. Occasionally, a bypass with low traffic volumes can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the ecomomic vitality of the local area.

Figure 11 shows the facilities of an idealized thoroughfare plan.

IDEALIZED THOROUGHFARE PLAN



LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE FREEWAY	▬▬▬	■ ■ ■ ■
MAJOR OTHER	▬▬▬	▬ ▬ ▬ ▬
MINOR THOROUGHFARE	———	– – – –
LOCAL ROAD	———	
INTERCHANGE	●	●
GRADE SEPERATION	○	○

LAND USES

- COMMERCIAL/BUSINESS
- RESIDENTIAL
- INDUSTRIAL
- PUBLIC/INSTITUTIONAL

FIGURE 11

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, system efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, thoroughfare planning is done for established urban areas and is constrained by existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these and the many other factors that affect major street locations. Appendix E explains the process used to develop the Thoroughfare Plan for Boiling Springs.

Through the thoroughfare planning process it is necessary form a practical viewpoint that certain basic principles be followed as closely as possible. These principles are listed below:

1. The plan should be derived from a thorough knowledge of today's travel - its component parts, and the factors that contribute to it, limit it, and modify it.

2. Traffic demands must be sufficient to warrant the designation and development of each major street. The thoroughfare plan should be designed to accommodate a large portion of major traffic movements on a few streets.

3. The plan should conform to and provide for the land development plan for the area.

4. Certain considerations must be given to urban development beyond the current planning period. Particularly in outlying or sparsely developed areas that have development potential, it is necessary to designate thoroughfares on a long range planning basis to protect right-of-way for future thoroughfare development.

5. While being consistent with the above principles and realistic in terms of travel trends, the plan must be economically feasible.

Thoroughfare Plan Street Tabulation and Recommendations

Facility & Section	Existing Cross-Section							Practical Capacity Current (Future)	1994 ADT's	2020 ADT's Exist System	Recommended X-Section **	
	S.I. Units			English Units			Number of Lanes				Rdwy (ult)	ROW (ult)
	DIST (km)	RDWY (m)	ROW (m)	DIST (mi)	RDWY (ft)	ROW (ft)						(ft / m)
Major Thoroughfares												
E. College Ave (NC150)												
from Main St. to ECL.	1.80	7.32	18.30	1.12	24	60	2	9,600	6,000	10,810	H	60' / 18 m
from ECL to Skinner Road	1.53	7.32	18.30	0.95	24	60	2	9,600	3,800	8,759	C	90' / 60 m
W. College Ave (SR 1003) *from WCL to NC 150*	1.77	6.10	NA	1.10	20	NA	2	9,600	5,500	11,050	H	60' / 18 m
N. Main St. (SR 1161)												
from NC 150 to Bethel Ave.	0.40	12.20	NA	0.25	40	NA	2	9,600	4,750	7,100	ADQ	ADQ
from Bethel Ave. to NCL	1.06	7.32	NA	0.66	24	NA	2	9,600	2,400	3,658	ADQ	ADQ
S. Main St. (NC 150 S.)												
from SCL to Branch Ave.	1.38	5.49	18.30	0.86	18	60	2	9,600	4,300	5,774	ADQ	ADQ
from Branch Ave. to SR 1149	0.39	7.32	18.30	0.24	24	60	2	9,600	6,500	10,810	C	90' / 60 m
Eastern Bypass- Patrick Ave. SR 1149	2.74	6.10	NA	1.70	20	NA	2	(9,600)	NA	4,314	J	60' / 18 m
Long Range Bypass - Ext of Patrick Ave.	1.98	6.10	NA	1.23	20	NA	2	(9,600)	NA	2,965	J	60' / 18 m
East Homestead Ave (SR 1158)	2.29	6.10	18.30	1.42	20	60	2	8,000	1,900	2,410	K	100' / 30 m
West Homestead Ave. (SR 1158)	1.75	5.49	18.30	1.09	18	60	2	8,000	800	1,805	K	100' / 30 m
Skinner Rd. (SR 1159) *from NC 150 to SR 1161*	4.51	5.49	NA	2.80	18	NA	2	4,800	400	1,802	K	100' / 30 m
Flint Hill Church Road(SR 1148)	2.37	5.49	NA	1.47	18	NA	2	4,800	950	1,555	ADQ	ADQ
Cliffside Rd (SR 1240) *From SR 1184 to W Homestead Ave.*	1.74	6.10	18.30	1.08	20	60	2	6,400	3,200	5,846	K	100' / 30 m

ECL = Eastern City Limits
WCL = Western City Limits

ADQ = Adequate

Appendix B

Process for Placement of a Project in the Transportation Improvement Program

The process for attempting to get a project into the TIP is described briefly in this appendix.

The local planning board should first decide on which projects they would like funded and placed in the TIP book. They should not try and attempt to get all of the improvements recommended in the thoroughfare plan into the TIP but select carefully a few of the projects that would provide the greatest impact on the traffic network in the area. These projects should be prioritized by the planning board and summarized briefly, as shown on Appendix Page B-2.

After determining which projects are needed in the area then an official letter for the TIP Project Request should be written to the N.C. Board of Transportation member from the municipality's respective district. Along with the letter, should be the prioritized summary of proposed projects for funding, a TIP Candidate Project Request Form for every project that is to be considered for funding and inclusion in the TIP, and a map that describes the location of each project that is being proposed for funding. An example of each one of these items is included in this appendix on the pages that follow.

CITY OF ROCKY MOUNT

OFFICE OF
THE CITY MANAGER

November 14, 1994

Mr. Clark Jenkins, Member
N.C. Board of Transportation
N.C. Department of Transportation
P.O. Box 25201
Raleigh, NC 27611-5201

RE: 1996-2002 TIP Project Requests
Rocky Mount Metropolitan Area

Dear Mr. Jenkins:

Enclosed find the projects requested by the Rocky Mount Metropolitan Area for consideration in the next TIP update. The list is presented by priority, as approved by the Rocky Mount Area Transportation Advisory Committee (TAC) on November 9, 1994.

The Transportation Advisory Committee also endorsed the existing schedule of projects contained in the current TIP for the Rocky Mount urban area, with one request. The TAC requests that TIP Project #U-2310 specifically include intersection improvements on the north side of the intersection of NC 97 (Raleigh Road) and Nashville Road. This intersection is very restricted and the TAC wants to ensure that improvements are considered as part of the widening project.

We thank you for the opportunity to participate in development of the state TIP. Please contact us immediately if additional information is needed concerning any of the enclosed project requests.

Sincerely,

Peter Varney

Peter F. Varney
Assistant City Manager

Enclosure

One Government Plaza • Post Office Box 1180 • Rocky Mount, North Carolina 27802-1180

ROCKY MOUNT METROPOLITAN AREA
TRANSPORTATION ADVISORY COMMITTEE

1994 PROPOSED HIGHWAY PROJECTS (FINAL)

US 301 Bypass from Benvenue Road to May Drive — NASH
- on 1995-2001 TIP for feasibility (#U-3330)
- Request project funding & schedule, and request extension of project to north of Tiffany Blvd. intersection

Abbott Labs Road and SR 1400 improvements — EDGECOMBE & NASH
- on 1995-2001 TIP for feasibility (#U-3329)
- Request project funding and schedule

Country Club Road from Jeffreys to US 64 — NASH
- ON 1995-2001 TIP for feasibility (#U-3331)
- Request project funding and schedule

Hunter Hill Road from Country Club Road to NC 43 — NASH
- Major thoroughfare approaching capacity
- Request widening to accommodate present & future traffic

Outer Loop: Southern Connector — EDGECOMBE & NASH
- Request feasibility study to determine the best location for rail, river & highway crossings required to connect sections of the outer loop

Halifax Road from Sunset to Bethlehem Road — NASH
- On 1995-2001 TIP for feasibility (#U-3316)
- Request project funding and schedule

Outer Loop: US 301 to Old Battleboro Road — EDGECOMBE
- Widen to accommodate traffic
- Possible realignment east of US 301 to eliminate offset at Fountain Correctional Center

Jeffreys Road from Benvenue Road to US 301 Bypass — NASH
- Widen to accommodate traffic
- Minor thoroughfare approaching capacity on segment between Fenner Road and US 301 Bypass

Nashville Road/Bridge over Tar River — NASH
- Stacking space insufficient for southbound traffic turning left onto Hammond Street
- Major thoroughfare

Bethlehem Road from Beechwood Drive to Halifax Rd — NASH
- Widen to accommodate future traffic from continuing development in this area and west of Halifax Road
- Thoroughfare plan designates as major thoroughfare

HIGHWAY PROGRAM
TIP CANDIDATE PROJECT REQUEST

(PLEASE PROVIDE INFORMATION IF AVAILABLE)

MPO Rocky Mount 2. DATE 11-14-94 3. PRIORITY NO. 1

ROUTE (US, NC, SR/Local Name) US 301 Bypass

PROJECT LOCATION (From/To/Length) NC 43/48 (Benvenue Rd) to Tiffany Boulevard (length revised from #u-3330 feasibility to include intersection at Tiffany Boulevard)

. TYPE OF PROJECT (Widening, New Facility, Resurfacing, Bridge Replacement, Signing, Safety, Rail Crossing, etc.)
Widening

. EXISTING CROSS SECTION _____ FEET, TYPE _____

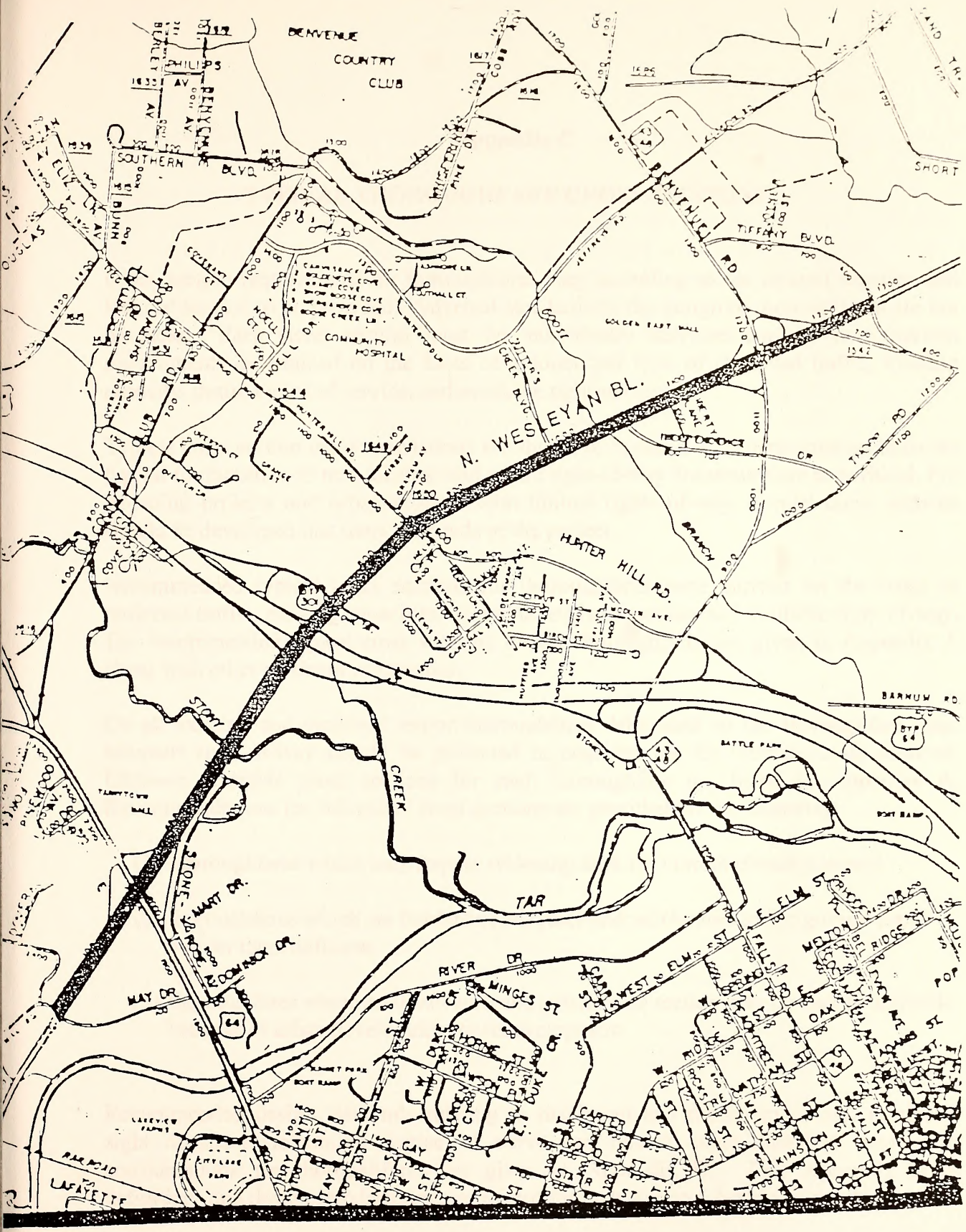
. EXISTING ROW _____ FEET 9. EXISTING ADT 29,386 (1992)

. ESTIMATED COST, ROW $ _____ CONSTRUCTION $ _____

. BRIEF JUSTIFICATION FOR PROJECT Major thoroughfare carrying increasing traffic from large commercial developments within this corridor and north-south through traffic. MPO requests funding & scheduling based on feasibility study results.

. PROJECT SUPPORTED BY (Agency/Group)
ROCKY MOUNT AREA TRANSPORATION ADVISORY COMMITTEE

PLEASE ATTACH MAP SHOWING PROJECT LOCATION



#1 US 301 BYPASS

N

Benvenue Rd (NC43/48) to May Drive

A - Four Lanes Divided with Median - Freeway

Cross section "A" is typical for controlled access freeways. The 14 m (46') grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228') depending upon cut and fill requirements.

B - Seven Lanes - Curb and Gutter

Cross section "B" should not be used for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as when widening from a five lane section and right-of-way is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "D" is the final cross section.

C - Five Lanes - Curb and Gutter

Cross section "C" is typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

D - Six Lanes Divided with Raised Median - Curb and Gutter
E - Four Lanes Divided with Raised Median - Curb and Gutter

Cross sections "D" and "E" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.8 m (16') median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

F - Four Lanes Divided - Boulevard, Grass Median

Cross section "F" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24') is recommended with 9.1 m (30') being desirable.

G - Four Lanes - Curb and Gutter

Typical cross section "G" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

H - Three Lanes - Curb and Gutter

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "H". Cross sections "I" and "J" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "J" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

I - Two Lanes - Curb and Gutter, Parking Both Sides
J - Two Lanes - Curb and Gutter, Parking One Side

Cross Sections "I" and "J" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross Section "I" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

K - Two Lanes - Paved Shoulder

This cross section is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For area that are growing and future widening will be necessary, the full right-of-way of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m. In those cases, 21 m (70 ft) should be preserved by use of building setbacks and future street line ordinances.

L - Six Lanes Divided with Grass Median - Freeway

Cross Section "L" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending on cut and fill requirements.

M - Eight Lanes Divided with Raised Median - Curb and Gutter

Also used for controlled access freeways, this cross sections may be recommended for freeways going through major urban areas or for routes projected to carry very high volumes of traffic.

N - Five Lane Roadway - Curb and Gutter, Widened Curb Lanes
O - Two Lanes - Shoulder Section
P - Four Lanes Divided with Raised Median - Curb and Gutter, Widened Curb Lanes

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities. Cross Sections "N", "O", and "P" are typically used to accommodate bicycle travel.

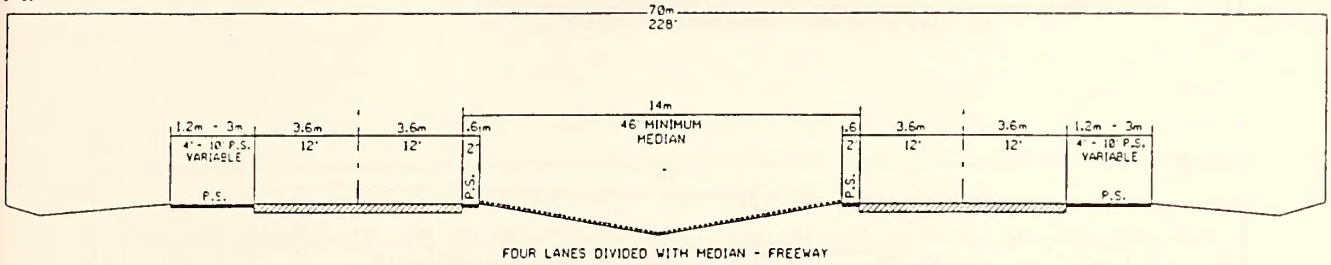
General

The urban curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The right-of-ways shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

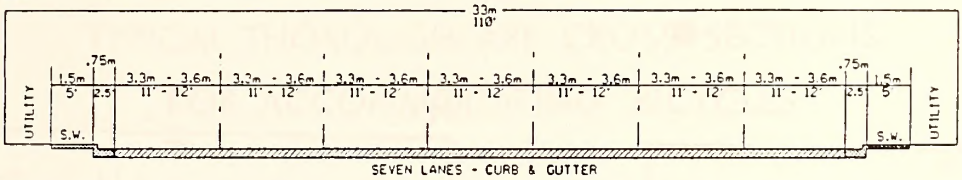
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



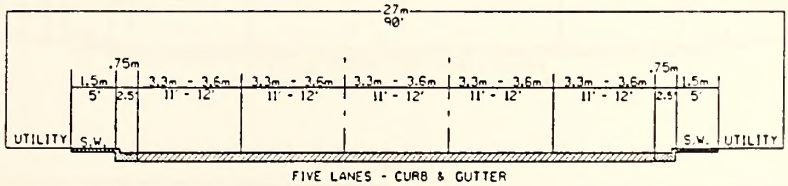
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



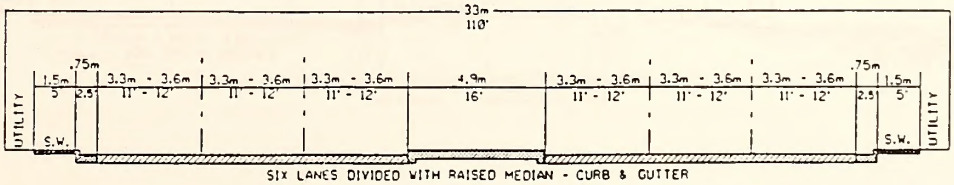
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

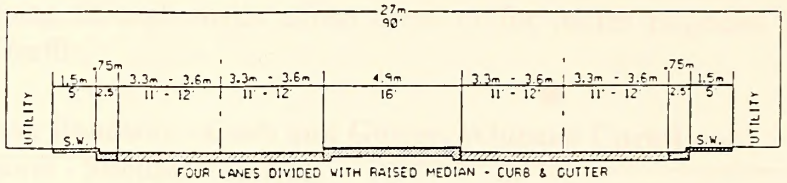
D.



SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

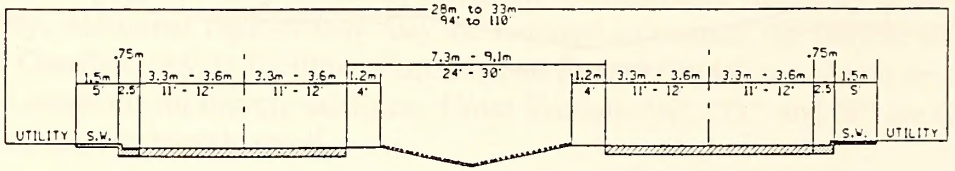
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



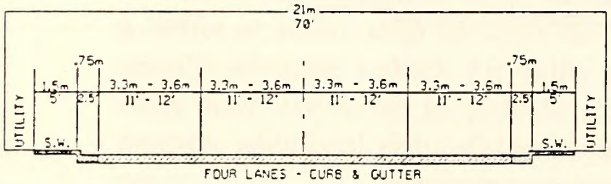
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



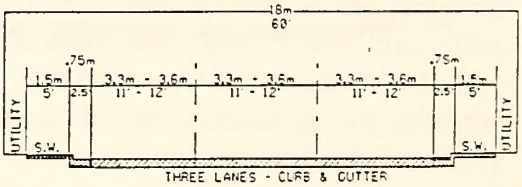
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



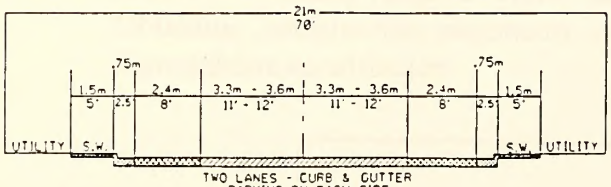
FOUR LANES - CURB & GUTTER

H.



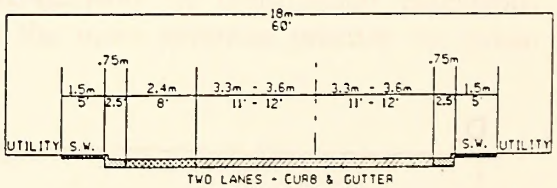
THREE LANES - CURB & GUTTER

I.



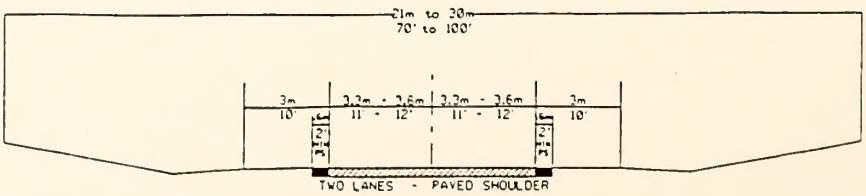
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



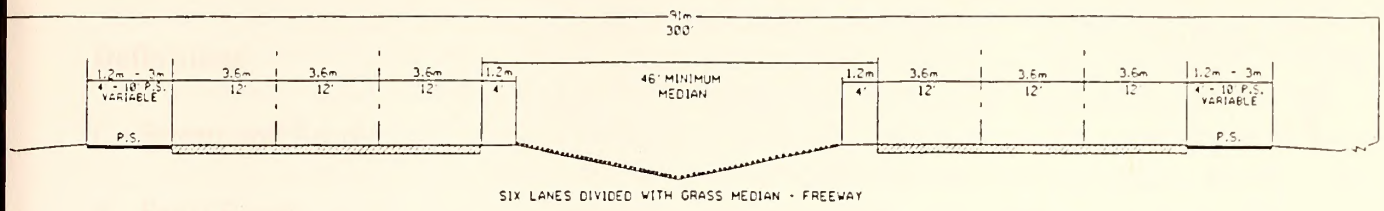
TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

K.



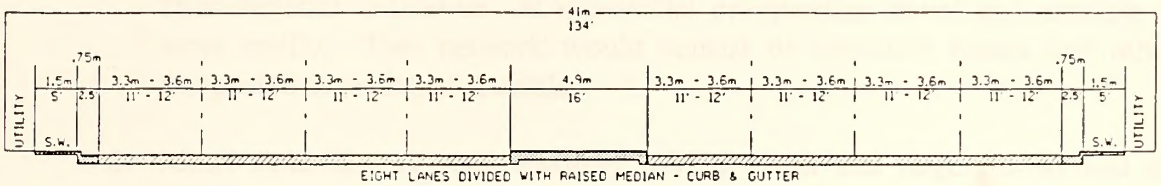
TWO LANES - PAVED SHOULDER

TYPICAL THOROUGHFARE CROSS SECTIONS



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

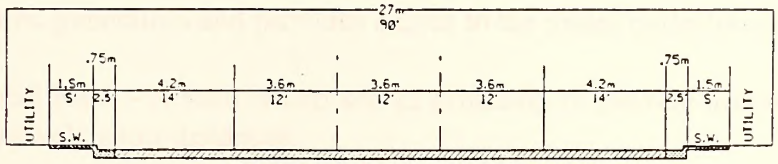
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

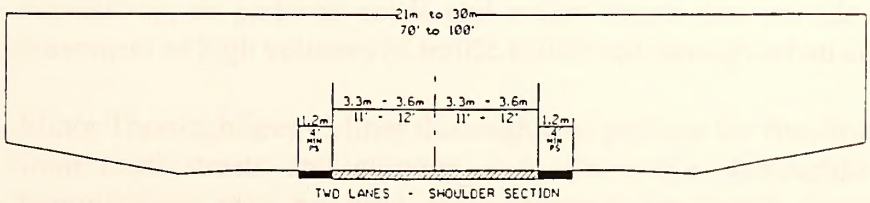
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



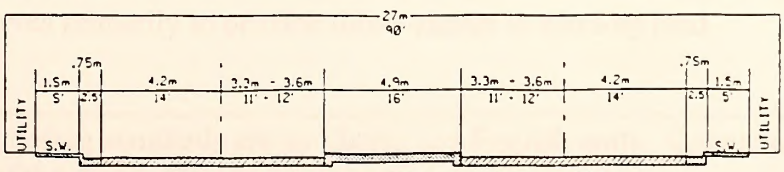
FIVE-LANE ROADWAY WITH CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

Appendix D

Recommended Subdivision Ordinances[1]

Definitions

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intrastate and inter-county service at relatively high overall speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intra-county travel corridors and traffic generators and provide access to the arterial system.

4. Minor Collector - a road which provides service to small local communities and traffic generators and provides access to the major collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of interstate, other freeway, expressway, or parkway roads and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perfrom the function of collecting traffic from local streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

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[1]The following design standards are in Metric and English units. Conversion factors are included on page D-10 of the Appendix.

C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway - Divided multilane road- ways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally with grade separations at major inter- sections. A parkway is for non-commercial traffic, with full or partial control of access.

2. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. Local Residential Street - Cul-de-sacs, loop streets less than 750 meters (2500 ft) in length, or streets less than one and a half kilometers in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

5. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

6. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides of develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development

and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than four hectares where no street right-of-way dedication is involved, (3) the public acquisition, by purchase, of strips of land for the widening or the opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than 0.8 hectares (.32 acres) into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the municipality. The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

1. Rural	**Min. ROW(m)**	**Min. ROW(ft)**
a. Principle Arterial - Freeways	105 meters	350 feet
- Other	60 meters	200 feet
b. Minor Arterial	30 meters	100 feet
c. Major Collector	30 meters	100 feet
d. Minor Collector	24 meters	80 feet
e. Local Road	18 meters	60 feet

2. Urban	Min. ROW(m)	Min. ROW(ft)
a. Major Thoroughfare other than Freeway and Expressway	27 meters	90 feet
b. Minor Thoroughfare	21 meters	70 feet
c. Local Street	18 meters[1]	60 feet
d. Cul-de-sac	Variable[2]	

The subdivider will only be required to dedicate a maximum of 30 meters (100′) of right-of-way. In cases where over 30 meters (100′) of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 30 meters (100′). On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than eighteen meters in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is sub-divided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. *Local Residential*
   Curb and Gutter section: 7.8 meters (26′), face to face of curb
   Shoulder section: 6 meters (20′) to edge of pavement, 1.2 meters (4′) for shoulders

2. *Residential Collector*
   Curb and Gutter section: 10.2 meters (34′), face to face of curb
   Shoulder section: 6 meters (20′) to edge of pavement, 1.8 meters (6′) for shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

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[1] The desirable minimum right-of-way (ROW) is 18 meters (60′). If curb and gutter is provided, 15 meters (50′) of ROW is adequate on local residential streets.

[2] The ROW dimension will depend on radius used for vehicular turn around. Distance from edge of pavement of turn around ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

1. Design Speed - The design speed for a roadway should be a minimum of 10 km/h greater than the posted speed limit. The design speeds for subdivision type streets shall be:

Facility Type	Design Speed					
	Desirable		Minimum			
			Level		*Rolling*	
	km/hr	mph	km/hr	mph	km/hr	mph
Rural						
Minor Collector Roads	100	60	80	50	70	40
Local Roads Including Residential Collectors and Local Residential	80	50	80	50	70	40
Urban						
Major Thoroughfares other than Freeway or Expressway	100	60	80	50	80	50
Minor Thoroughfares	100	60	80	50	70	40
Local Streets	70	40	70	40	50	30

2. Maximum and Minimum Grades

   a. The maximum grades in percent shall be:

Facility Type	Design Speed		Maximum Vertical Grade (Percent)		
	(km/h)	(mph)	Flat	Rolling	Mountainous
Rural					
Minor Collector Roads*	30	20	7	10	12
	50	30	7	9	10
	60	35	7	8	10
	90	55	6	7	9
	100	60	5	6	8
	110	70	4	5	6
Local Roads	30	20	--	11	16
Including Residential	50	30	7	10	14
Collectors & Local	60	35	7	9	12
Residential Streets*	90	55	6	8	10
	100	60	5	6	--
Urban					
Major Thoroughfares	50	30	8	9	11
other than Freeway	60	35	7	8	10
or Expressway	90	55	6	7	9
	100	60	5	6	8

Design Speeds Continued

Minor Thoroughfares[1]	30	20	9	10	12
	50	30	9	9	10
	60	35	9	8	10
	90	55	7	7	9
	100	60	6	6	8
	110	70	5	5	6
Local Streets[1]	30	20	-	12	17
	50	30	8	11	15
	60	35	8	10	13
	90	55	7	9	11
	100	60	6	7	-

b. Minimum grade should not be less than 0.5% .

c. Grades for 30 meters (105′) each way from intersections (measured from edge of pavement) should not exceed 5%.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

Sight Distance

Design Speed		**Stopping Sight Distance**			
		Minimum		*Desirable Minimum*	
km/h	mph	meters	feet	meters	feet
30	20	30	100	30	100
50	30	60	200	70	250
60	35	80	275	90	300
90	55	140	500	170	600
100	60	160	525	210	700

Design Speed		**Minimum K2 Value for:**			
		Crest		*Sag*	
km/h	mph	meters	feet	meters	feet
30	20	3	10	4	20
50	30	10	30	12	40
60	35	18	50	18	50
90	55	71	160	40	130
100	60	105	310	51	160

[1] For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters long (500′), grades may be 2% steeper than the values in the above table

[2]K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

4. The "Superelevation Table" shown below and continued on the next page shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

Superelevation Table

Design Speed		**Maximum e**	**Minimum Radius**	
km/h	*mph*		*meters*	*feet*
50	30	0.04	100	302
60	40	0.04	150	573
90	50	0.04	375	955
100	60	0.04	490	1528
50	30	0.06	90	273
60	40	0.06	135	509
90	50	0.06	335	849
100	60	0.06	435	1380
50	30	0.08	80	252
60	40	0.08	125	468
90	50	0.08	305	764
100	60	0.08	395	1206

e = rate of roadway superelevation, meter per meter

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters (200′) between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than one hundred and fifty (150) meters (500′) in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should

not be less than the distance from the edge of pavement to right-of-way line on the approaching the turn around. Cul-de-sacs should not be used to avoid connection with an ex street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least 6 meters (20′).

3. Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the dead-end as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9 meters (30′) from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters (6′) from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:
   a. Shoulder section approach
      I. Under 800 ADT design year
         Minimum 8.4 meters (28′) width face to face of parapets, rails, or pavement width plus 3 meters (10′), whichever is greater.

II. 800 - 2000 ADT design year

Minimum 10.2 meters (34′) width face to face of parapets, rails, or pavement width plus 3.6meters (12′), whichever is greater.

III. Over 2000 ADT design year

Minimum width of 12 meters (40′), desirable width of 13.2 meters (44′) width face to face of parapets or rails.

b. Curb and gutter approach

I. Under 800 ADT design year

Minimum 7.2 meters (24′) face to face of curbs.

II. Over 800 ADT design year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters (1′ 6″), or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 m (8′) minimum, 3 m (10′) desirable.)

b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

English To Metric Conversion Table

English Units		S.I. Units	Abbreviation
1 inch	equals	25.4 millimeters	(mm)
1 foot	equals	0.3 meters	(m)
1 mile	equals	1.6 kilometers	(km)
1 acre	equals	2.47 hectares	(hect)

Metric Equivalents

1 millimeter	equals	0.001 meters
1 kilometer	equals	1000 meters
1 hectare	equals	10,000 square meters

Appendix E

Procedure Used in Developing the Boiling Springs Thoroughfare Plan

In order to develop an effective thoroughfare plan for Boiling Springs it was necessary to develop and calibrate a traffic model of the Town. Using Technical Report #11, "Allocation Type Approach To Estimation of Travel for Small Urban Areas[1]," the Statewide Planning Branch developed the thoroughfare plan for the Town of Boiling Springs. To develop a traffic model the following things are necessary: define the study area, collect population, traffic counts and socioeconomic data, determine the trip generation characteristics of the study area, calibrate the traffic model so that it duplicates patterns of the study area, and project the traffic and socioeconomic data to the design year. Once the traffic and socioeconomic data have been projected the model may be used to evaluate various street system problems and alternate solutions to the problems.

Study Area

The first step in this procedure is to define the Planning Area. The study area for Boiling Springs consists of the Town and some additional outlaying areas (Figure 7). This area was divided into 6 traffic zones that reflect similar land use so that trips could be manually assigned to each zone.

Population

The next step was to determine the population of the Town of Boiling Springs and the surrounding area inside the planning boundary. The suggested procedure is the step-down approach, that is starting with the County population, then to the Township, and finally to the Planning Area. Using the statistics from the Office of the State Budget, population data was collected for Cleveland County from the year 1940 to the estimated population of 2020. The Township was the next subunit for population that was gathered for the study. The population of the township is a good way to break down the county population into smaller units, because the township boundaries almost never change they can be used to trend line the population to the future year. Finally, the population of the Planning Area is estimated as a percent of the Township population. In this case an aerial photograph was used to count the number of houses outside the city limits and inside the planning area. This number was projected for the future year and added to the town's population.

[1] Allocation Type Approach to Estimation of Travel for Small Urban Areas, Technical Report #11, Statewide Planning Branch, May 1989

Year	Cleveland County	Boiling Springs Township	Boiling Springs Town	Township % of County
1940	58,055	2,925	613	5.04
1950	64,357	3,876	1,145	6.02
1960	66,048	3,822	1,311	5.78
1970	72,556	5,193	2,284	7.15
1980	83,435	5,773	2,381	6.92
1990	84,713	6,060	2,445	7.15
2000	89,916a	6,520c	2,700b	7.25b
2010	89,208a	6,467c	2,982b	7.25b
2020	87,737a	6,361c	3,293b	7.25b

a/Estimate by Office State Budget and Management
b/Projection based on past trends
c/Estimated County Population x Township % of County

Planning Area Population Estimates

1994	2531 + 212(2.47 persons/DU) = 3054
2020	3293 + 392(2.22 persons/DU) = 4164

number of houses outside the town's limits in 1994 = 212
number of houses projected outside town's limits in 2020 = 392
* due to an increase in building permits housing projection was estimated at 2.4%
* 2.47 persons per household (1994)
* 2.22 Persons per household in (2020)

External and Through Trips

Now that the population data has been gathered and estimated the next step is to gather the traffic counts in the study area. Traffic counts were gathered for the Planning Area over the past twenty six and trend lined to the year 2020. Using traffic count information, traffic volumes were estimated for the study area at the external stations. External stations are points that lie on the Planning Area boundary that intersect with the highway network. After studying the area and talking to personal from the Traffic Forecasting Unit an estimate for through trip and truck percentages on different routes were determined. Once all the data was determined for the Planning Area of Boiling Springs, using the Technical Report #3, "Synthesized Through Trip Table for Small Urban Areas[2]," and it's computer supplement along with the SYNTH program, an estimate of the number of through trips was determined for each external station. Subtracting the through trips from the total trips at the external stations, the number of external trip generated were calculated. The following table shows these calculations for the base and design year.

Estimated Through Trips

Station	1994		2020	
	Total	Through	Total	Through
SR 1161	2500	556	4643	1276
SR 1158	800	96	1957	400
NC 150E	6000	1572	12239	4552
SR 1148	350	70	755	172
NC 150S	2000	512	4313	1544
SR 1195	80	14	90	10
SR 1194	60	10	129	26
SR 1003	1879	454	4056	1414
SR 1164	40	4	76	14
Total		**3,288**		**9,408**

Estimated External Trips

Station	1994 External	2020 External
SR 1161	1944	3367
SR 1158	704	1557
NC 150E	4428	1687
SR 1148	280	583
NC 150S	1488	2769
SR 1195	66	80
SR 1194	50	103
SR 1003	1425	2642
SR 1164	36	62
Total	**10,421**	**18,850**

[2] Synthesized Through Trip Table for Small Urban Areas, Technical Report #3, Dr. David G. Modlin Jr., October 1980.

Trip Generation

The trip generation process is the process by which population and development in the Planning Area are used to determine the total number of trips generated. This is done by converting the population to dwelling units (DU), then dividing the population of the study area by the estimated persons per dwelling unit. After determining the number of dwelling units, it is multiplied by an assumed trip generation rate per dwelling unit to find the trip produced by the dwelling units. Then solve for the number of trips produced by commercial autos and trucks. This is found by again assuming a trip generation rate for the commercial vehicles and then multiplying it by the number of trips produced by the dwelling units. Finally adding the number of trips produced by the dwelling units and the commercial vehicles, determines the total number of trips produced in the Planning Area. Do this for both the base and design year as shown in the following table for the Town of Boiling Springs.

Estimated Trips per Dwelling Unit

1994 DU Trips:	(3054/2.47)a x 9.0b = 11,128
	.084c x 11,128 = 936
	Total = 12,064
2020 DU Trips:	(4164/2.22)a x 9.5d = 17,819
	.084c x 17,819 = 1497
	Total = 19,316

a ➔ Estimated persons/DU in 1994 and 2020
b ➔ Estimated DU trip generation rate in 1994
c ➔ Estimated commercial vehicle trips as percent of DU trips based on data from Table 1 of Technical Report #11
d ➔ 1994 trip generation rate factored to 2020 based on anticipated changes in auto ownership, auto usage, and persons/DU

Internal Trips - After the total number of trips produced is determined for both the base and design years it is reduced to eliminate trips to destinations outside the Planning Area. This is done by taking the total number of trips produced and multiplying it by the percent of internal of total trips. Here is that calculation of the Boiling Springs Study:

Reduced Internally Generated Trips

1994 internal trips = 12,064 x .68a = 8,203
2020 internal trips = 19,316 x .68a = 13,135

a ➔ Estimate based on least populated town in Table 1 of Technical Report #11.

Internal Travel - The next step was to find the total internal travel, which is the total number of internal and secondary trips. Secondary trips are trips that are generated by external traffic. An example of a secondary trip is a trip that comes from outside the planning area to inside the planning area to work, then on its way home from work it stops at the grocery store or the dry cleaners before leaving the planning area, these are considered secondary trips. To find the total internal travel add the internal trips to the secondary trips. The secondary trips are a percentage of the external trips that enter the Planning Area. This is estimated at 10% for the Boiling Springs area. This procedure is done for both the base and design years. The example for Boiling Springs is as follows:

Internal Travel

Total 1994 internal travel = 8,203 + (6560 x .10) = 8859
Total 2020 internal travel = 13,135 + (12669 x .10) = 14402

Trip Tables

After all the calculations have been made: the through, external and internal trip tables for both the base year and design year should be developed. These tables will be helpful later in assigning the trips throughout the Planning Area.

Through Trips

Using a straight line sketch of the Planning Area, the procedures outlined in Technical Report #3, and the SYNTH program output, the through trips are manually assigned to the external stations. For the Boiling Springs study the through trips are shown in Figure E-1.

External Trips

Again using a straight line sketch and a zone map of the Planning Area, the external trips should be assigned to the internal zones based on relative trip attractiveness based on the knowledge of land uses in each zone. It is best to start with the major external stations and then assign trips from minor station to the internal zones. This assignment can be done two ways; one is by using information from an external station origin destination traffic survey as a guide. The other is to get a feel for the area and what's located in each zone and then assign trips. The latter of the two way was done for the Town of Boiling Springs. The assignment of external trips can seen in Figure E-2.

Internal Trips

The internal trips are treated in a similar manner as the external trips except that the total number of internal trips must first be assigned to the internal zones. Some trips must be distributed as intrazonal trips. So again, by using a straight line sketch and the zone map, trips are distributed within the zone and between zones. This procedure is illustrated in Figure

Assignment of Trips

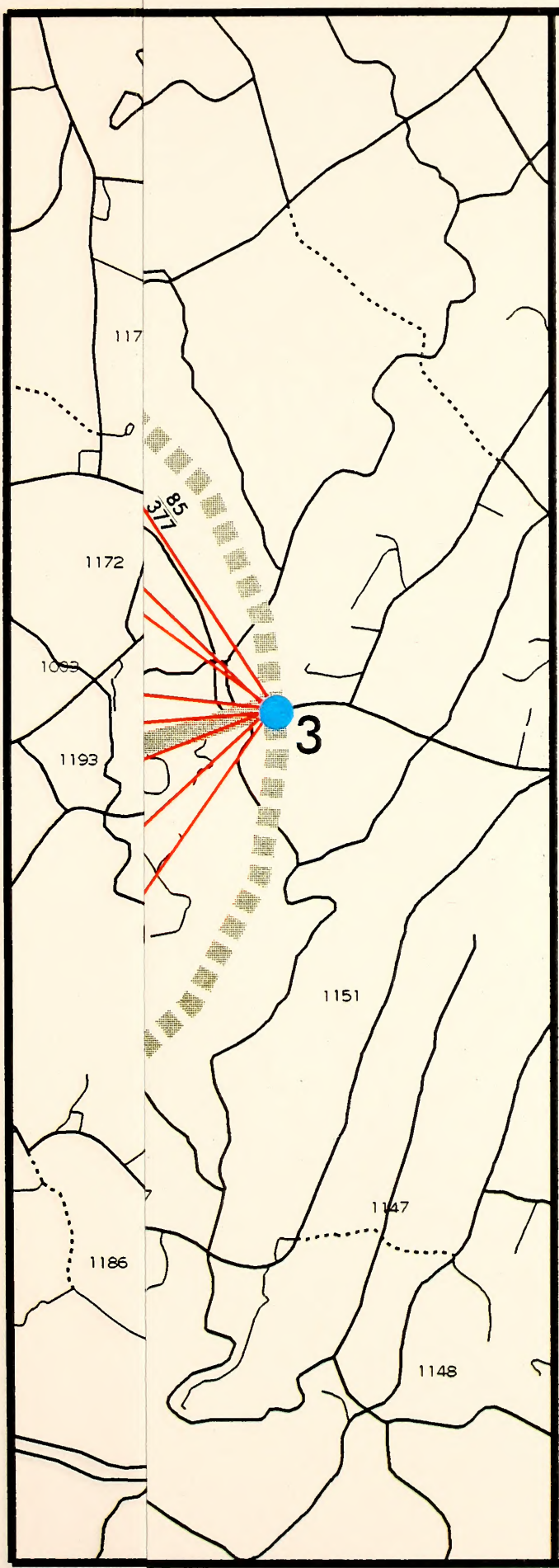
Base Year

Once the stickline sketches have been developed for the through, external, and internal trips for the base year they should be assigned to the existing major street system and checked against ground counts in the Planning Area. The assignment can be done by hand or by computer traffic assignment. By doing a hand allocation this provides a better knowledge of traffic movements that will be useful in any benefits analysis. For the Boiling Springs Thoroughfare Plan a spreadsheet and the base map was used to keep track of travel movements. In doing the assignment of trips each type of trip was assigned individually then totaled at each count location in the Planning Area. After all trips were assigned to the highway network these totals were compared to actual counts that were taken at that location. This process is done until the assigned counts are close to the actual counts taken in the field and the model is calibrated. Table E-1 shows the base year trip assignment for the Boiling Springs Planning Area. See Figure E-4 for traffic count locations used in Tables E-1 and E-2.

Future Year

After the base year traffic assignment has been calibrated then the trips that are calculated for the design year are distributed as was done for the base year. The assignment takes into account were the town expects growth and how this will effect travel demand in the Planning Area. The trip assignment for the design year is shown in Table E-2.

Now that all the trips have been distributed for both the base and design years this data can be used to determine where problem areas are and how they can be improved. This is the bases of how the thoroughfare plan for the Town of Boiling Springs was developed and how recommendations were made.



THROUGH TRIPS
1994 & 2020

LEGEND

Planning Area Boundary

Zones

Through Trips 1994 / 2020

FIGURE E-1

BOILING SPRINGS

CLEVELAND COUNTY
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers

0 1000 2000 3000 4000
feet

Assignment of Trips

Base Year

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Future Year

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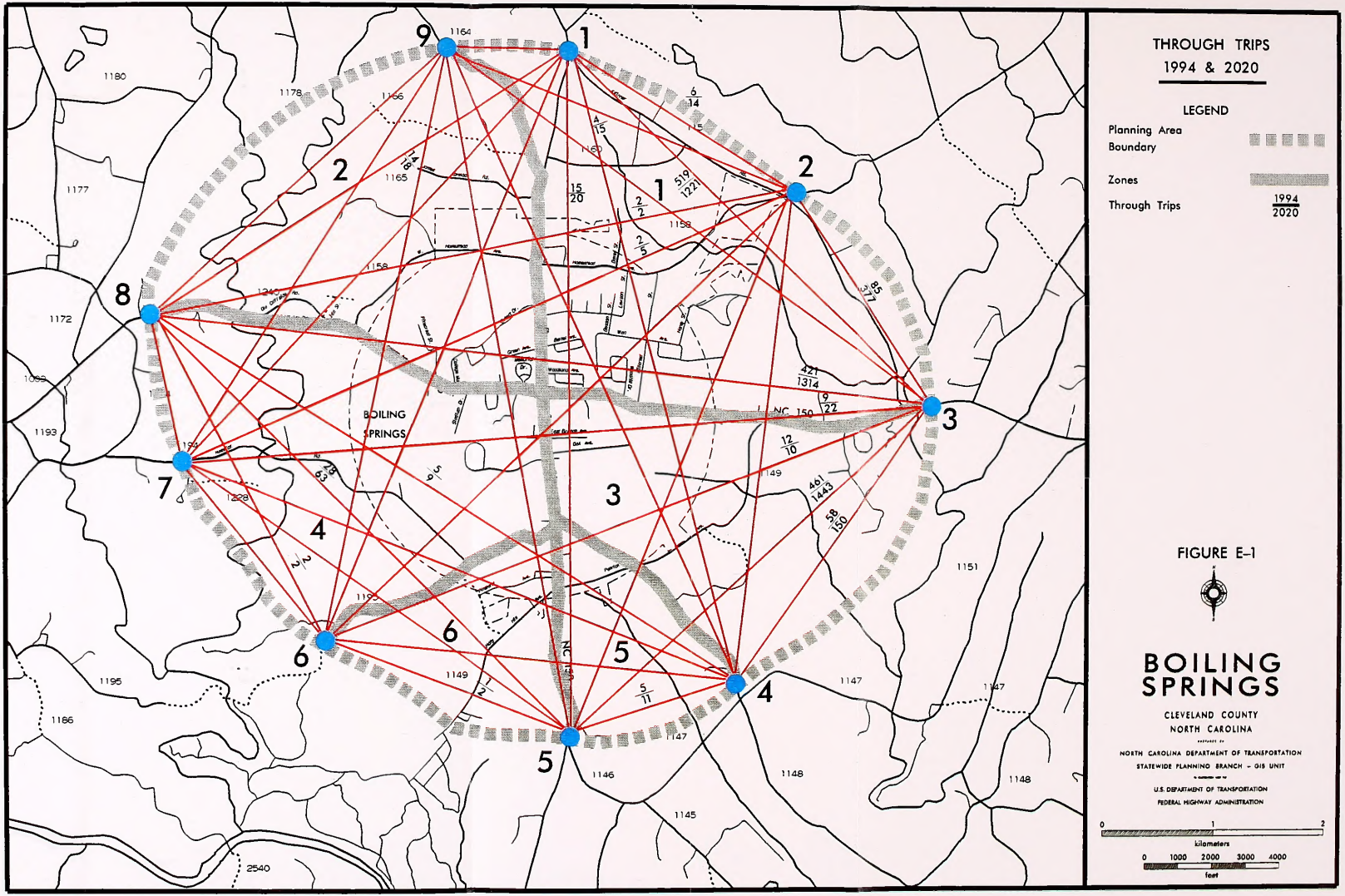
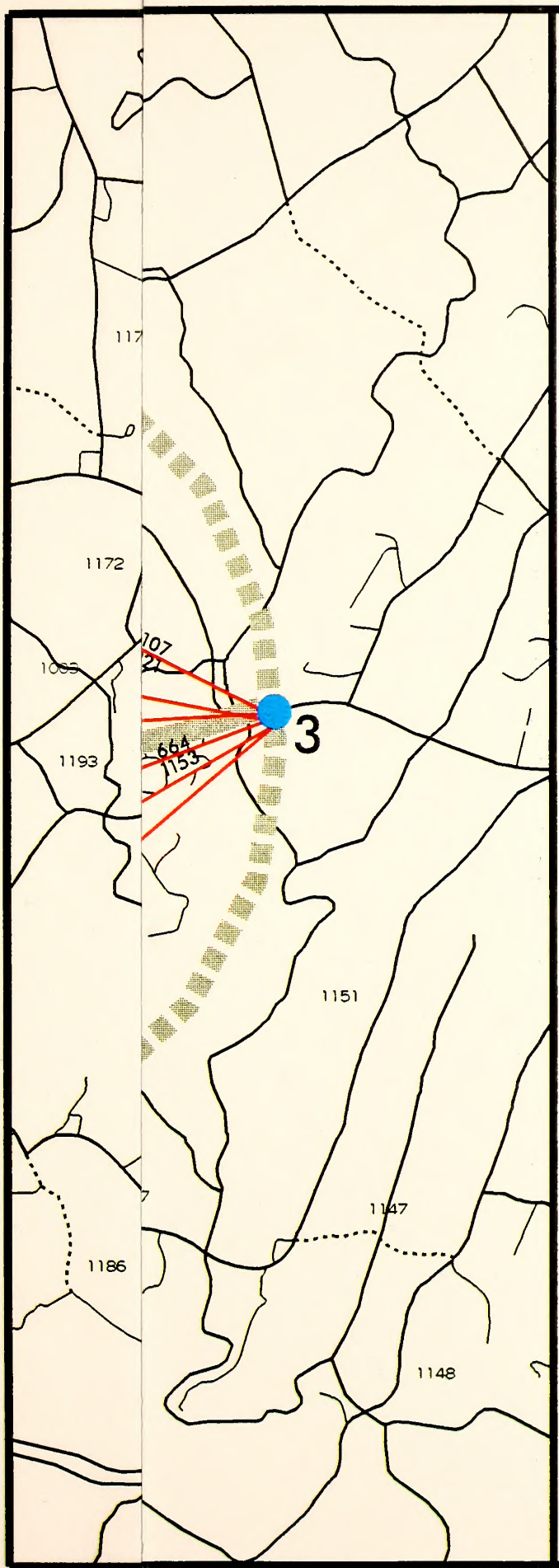

THROUGH TRIPS
1994 & 2020
LEGEND
Planning Area Boundary
Zones
Through Trips 1994/2020
BOILING SPRINGS
NC 150
1 2 3 4 5 6 7 8 9
BOILING SPRINGS
CLEVELAND COUNTY
NORTH CAROLINA
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
kilometers
feet

FIGURE E-1



EXTERNAL TRIPS
1994 & 2020

LEGEND

Planning Area Boundary

Zones

External Trips 1994 / 2020

FIGURE E–2

BOILING SPRINGS

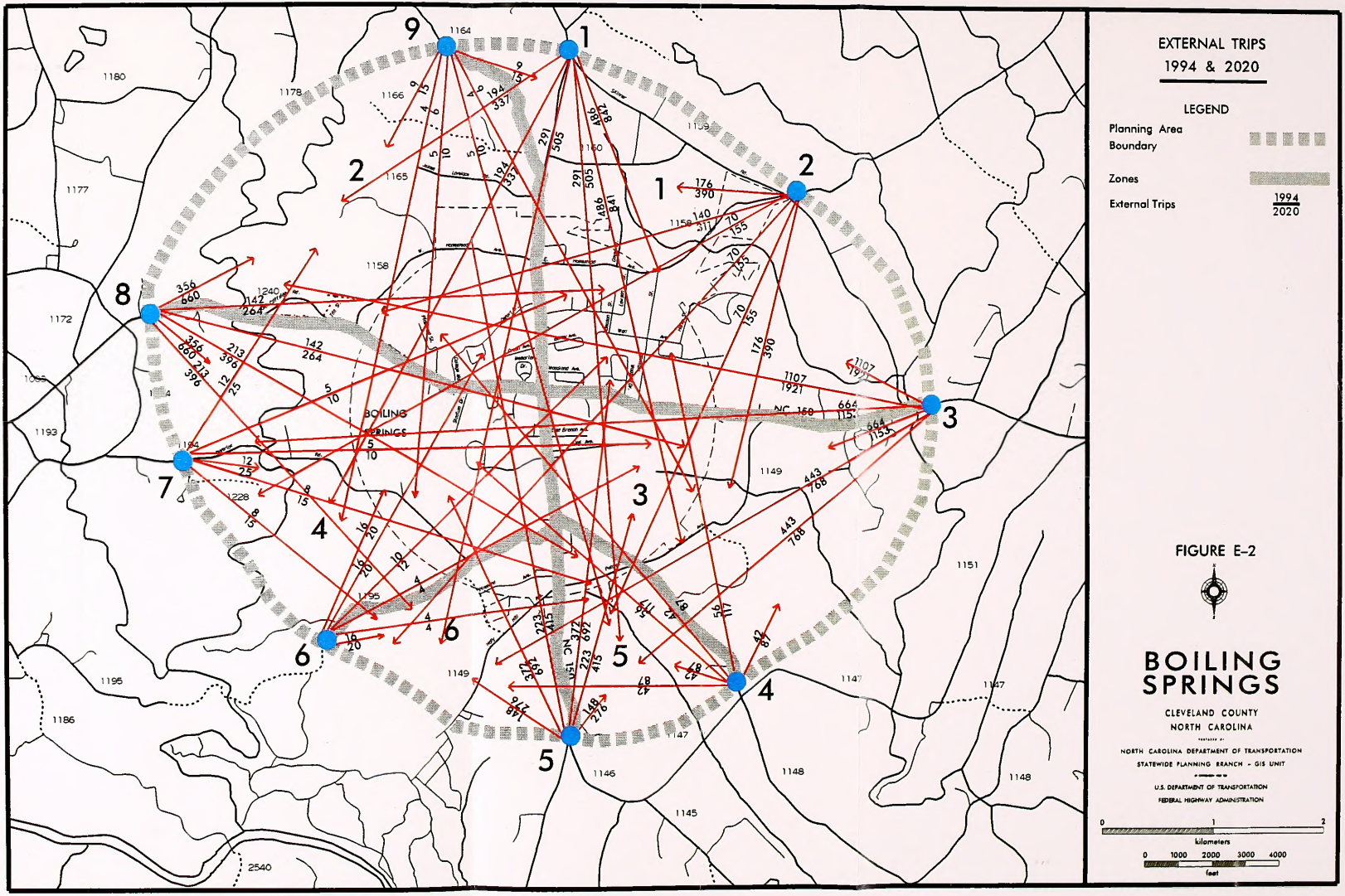
CLEVELAND COUNTY
NORTH CAROLINA

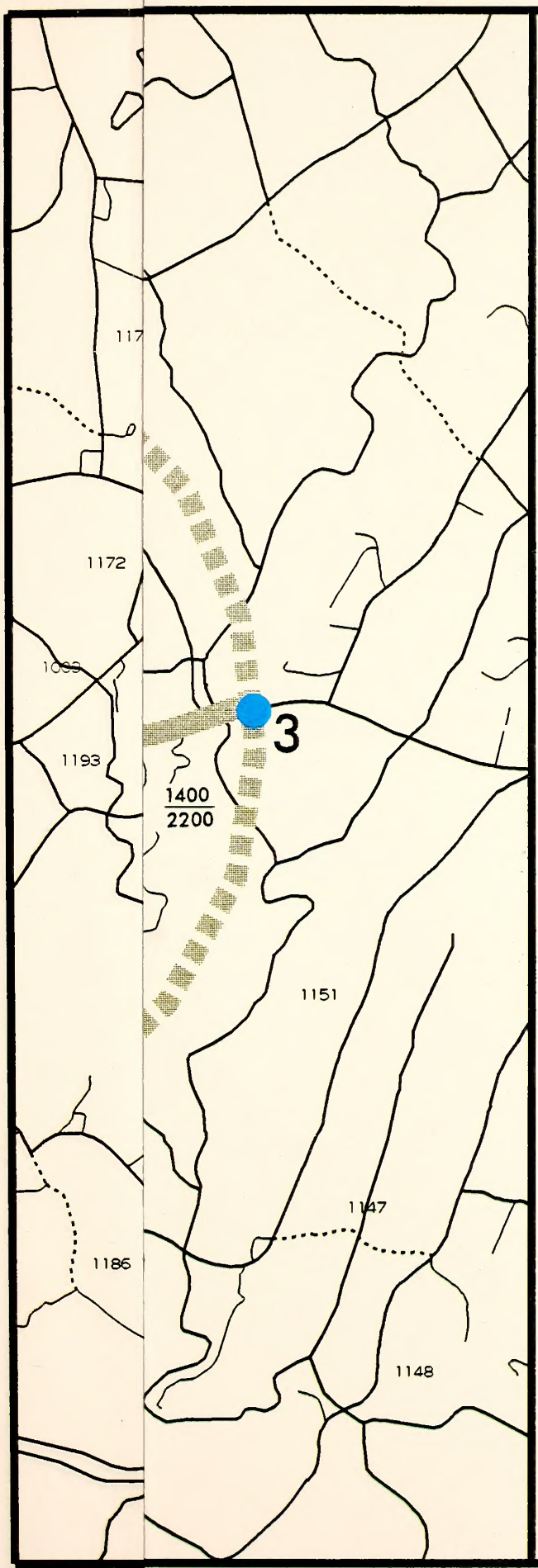
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH – GIS UNIT

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers

0 1000 2000 3000 4000
feet


EXTERNAL TRIPS
1994 & 2020
LEGEND
Planning Area Boundary
Zones
External Trips
1994
2020
FIGURE E-2
BOILING SPRINGS
CLEVELAND COUNTY
NORTH CAROLINA
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
kilometers
feet
BOILING SPRINGS
NC 150
NC 161



INTERNAL TRIPS
1994 & 2020

LEGEND

Planning Area Boundary

Zones

Internal Trips 1994 / 2020

FIGURE E–3

BOILING SPRINGS

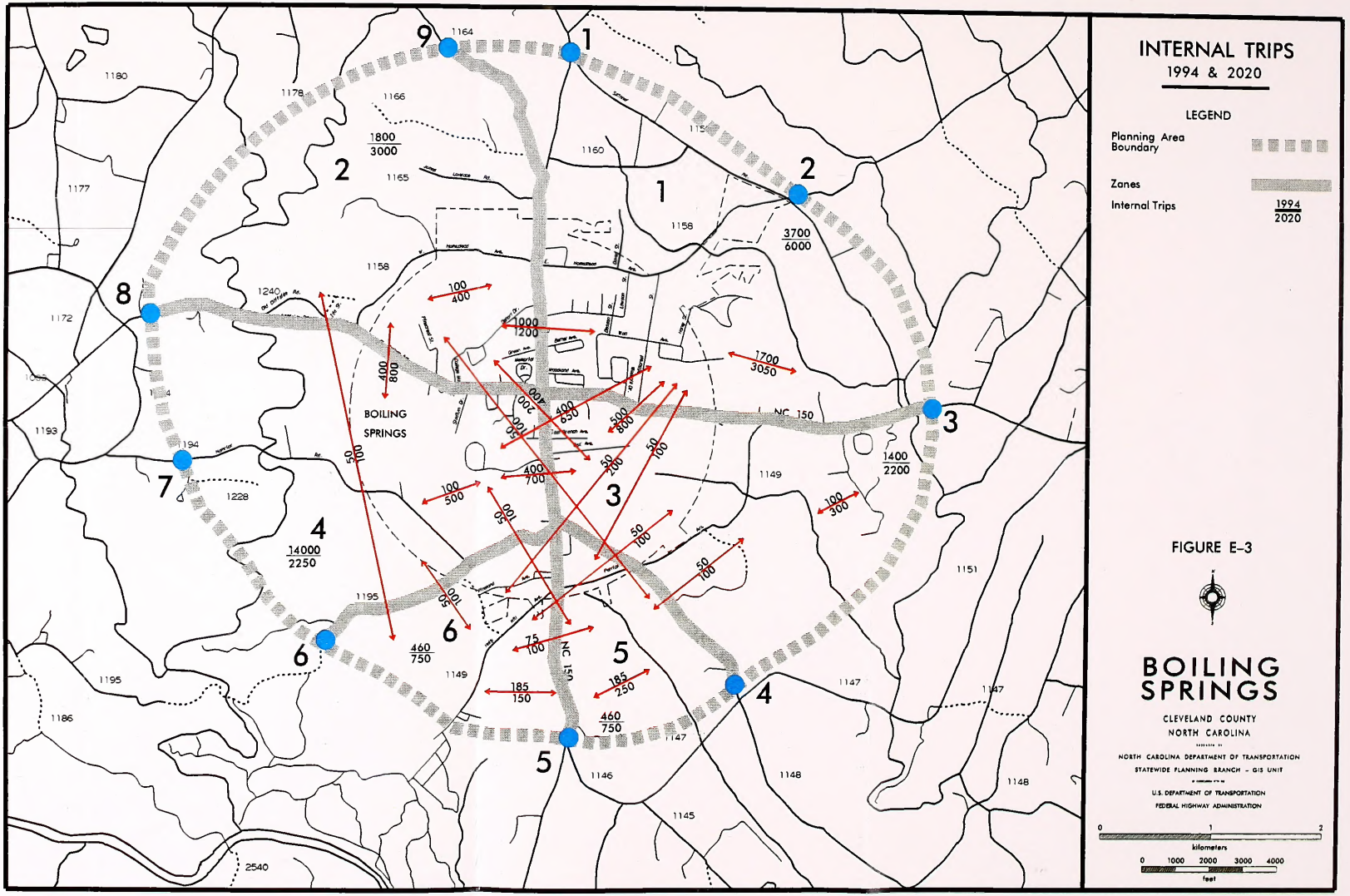
CLEVELAND COUNTY
NORTH CAROLINA

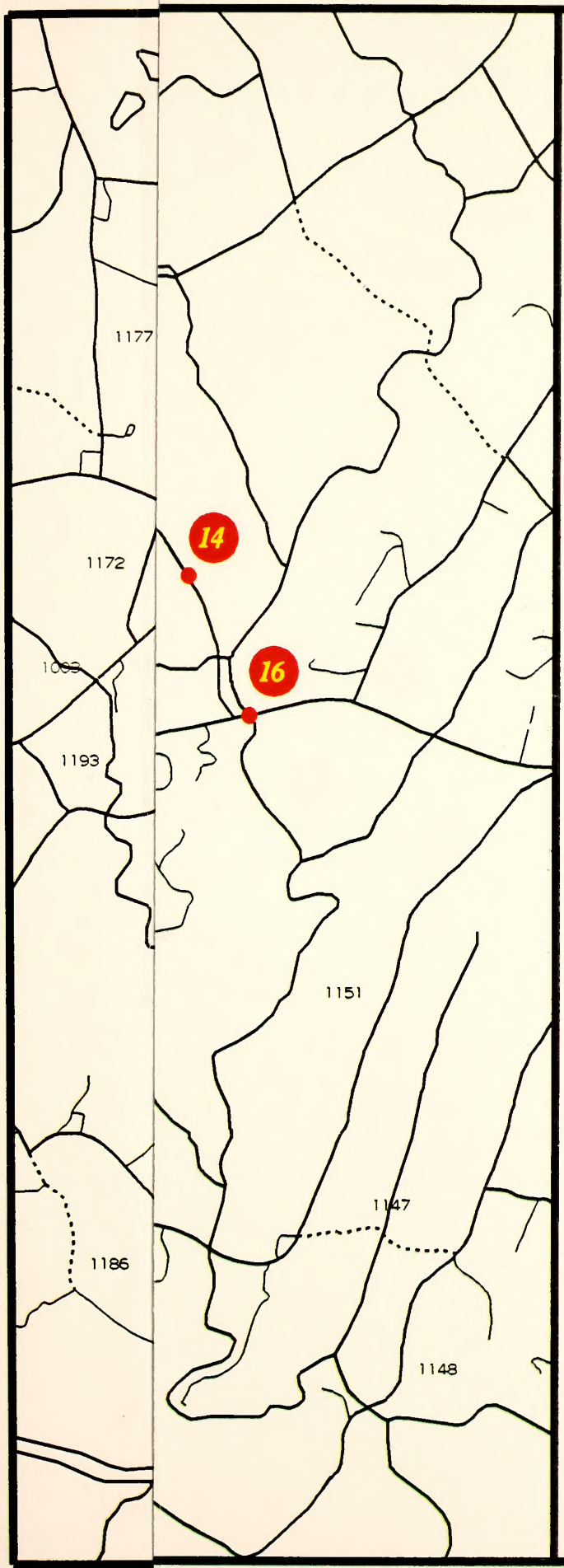
PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH – GIS UNIT

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers

0 1000 2000 3000 4000
feet


INTERNAL TRIPS
1994 & 2020
LEGEND
Planning Area Boundary
Zanes
Internal Trips 1994 / 2020
FIGURE E-3
BOILING SPRINGS
CLEVELAND COUNTY
NORTH CAROLINA
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
kilometers
feet
BOILING SPRINGS
NC 150
NC 150
1800/3000
3700/6000
1400/2200
14000/2250
460/750
460/750
1 2 3 4 5 6 7 8 9



COUNT LOCATION MAP

COUNT LOCATION

FIGURE E-4

BOILING SPRINGS

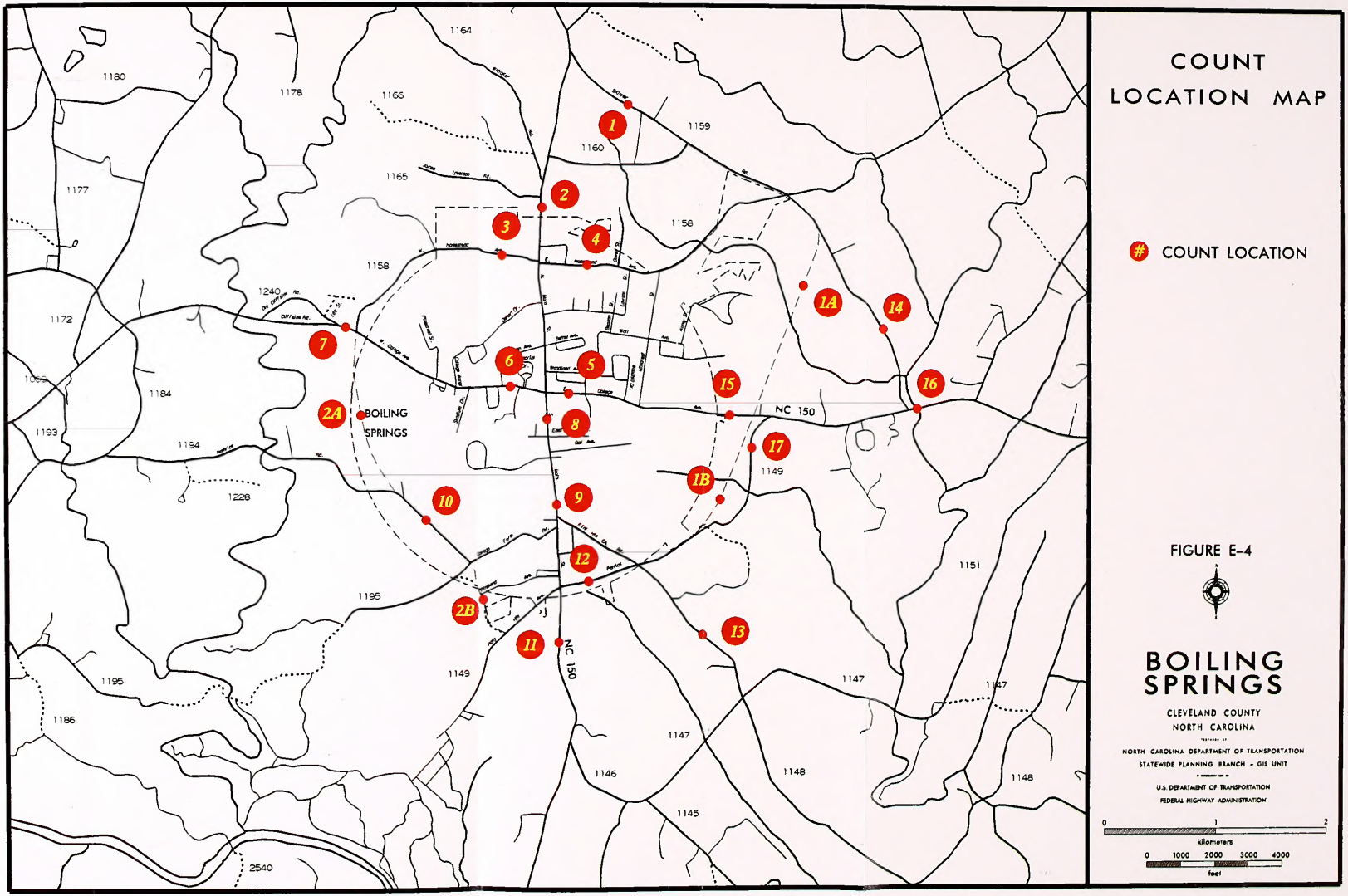
CLEVELAND COUNTY
NORTH CAROLINA

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1 2
kilometers

0 1000 2000 3000 4000
feet


COUNT
LOCATION MAP
COUNT LOCATION
1
2
3
4
5
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8
9
10
11
12
13
14
15
16
17
1A
1B
2A
2B
BOILING
SPRINGS
NC 150
FIGURE E-4
BOILING
SPRINGS
CLEVELAND COUNTY
NORTH CAROLINA
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH - GIS UNIT
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
0 1 2
kilometers
0 1000 2000 3000 4000
feet

Boiling Springs Trip Assignment Table 1994

	PT1	PT2	PT3	PT4	PT5	PT6	PT7	PT8	PT9	PT10	PT11	PT12	PT13	PT14	PT15	PT16	PT17
Through																	
SR 1161	525	31	0	0	0	14	14	17	17	0	15	15	2	519	0	0	0
SR 1158	0	0	2	4	0	0	2	2	2	0	2	2	0	85	0	85	0
NC 150 E	0	4	0	0	886	421	421	0	0	0	461	461	58	0	886	4	58
SR 1148	0	0	0	0	0	5	5	5	5	0	5	5	10	0	0	0	0
NC 150 S	0	0	0	0	0	28	28	28	28	0	28	28	0	0	0	0	0
SR 1195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR 1194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR 1003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR 1164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**525**	**35**	**2**	**4**	**886**	**468**	**470**	**52**	**52**	**0**	**511**	**511**	**70**	**604**	**886**	**89**	**58**
External	**PT1**	**PT2**	**PT3**	**PT4**	**PT5**	**PT6**	**PT7**	**PT8**	**PT9**	**PT10**	**PT11**	**PT12**	**PT13**	**PT14**	**PT15**	**PT16**	**PT17**
SR 1161	244	1944	0	0	0	850	0	850	0	0	0	0	0	0	0	244	0
SR 1158	0	0	200	500	0	150	200	150	0	0	0	0	0	0	0	204	0
NC 150 E	0	0	0	0	3228	1500	0	1728	0	0	0	0	0	0	3228	4428	1200
SR 1148	0	0	0	0	0	0	0	180	180	0	0	0	280	0	0	0	0
NC 150 S	0	0	0	300	0	0	0	1000	1000	0	1488	1488	0	0	0	0	0
SR 1195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR 1194	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0
SR 1003	0	0	0	0	0	1425	1425	425	425	0	0	0	0	0	0	0	0
SR 1164	0	9	0	0	0	0	0	36	0	0	0	0	0	0	0	0	0
Total	**244**	**1953**	**200**	**800**	**3228**	**3925**	**1625**	**4369**	**1605**	**50**	**1488**	**1488**	**280**	**0**	**3228**	**4876**	**1200**
Internal	**PT1**	**PT2**	**PT3**	**PT4**	**PT5**	**PT6**	**PT7**	**PT8**	**PT9**	**PT10**	**PT11**	**PT12**	**PT13**	**PT14**	**PT15**	**PT16**	**PT17**
Zone 1 to	0	0	500	1500	1300	700	500	700	400	0	50	50	0	0	0	0	0
Zone 2 to	0	100	300	0	0	600	300	700	700	0	0	0	250	0	0	0	0
Zone 3 to	0	0	0	0	500	0	0	550	100	0	50	0	50	0	500	0	0
Zone 4 to	0	0	0	0	0	0	0	100	100	0	50	0	100	0	0	0	0
Zone 5 to	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0
Zone 6 to	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**100**	**800**	**1500**	**1800**	**1300**	**800**	**2050**	**1300**	**0**	**225**	**50**	**400**	**0**	**500**	**0**	**0**
Total Trips	769	2088	1002	2304	5914	5693	2895	6471	2957	50	2224	2049	750	604	4614	4965	1258

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Table E2

Boiling Springs Trip Assignment Table 2020

	PT1	PT2	PT3	PT4	PT5	PT6	PT7	PT8	PT9	PT10	PT11	PT12	PT13	PT14	PT15	PT16	PT17
Through																	
SR 1161	1235	40	0	0	0	18	18	22	22	0	20	20	2	1221	0	0	0
SR 1158	0	0	5	10	0	0	0	5	5	0	5	5	0	377	0	377	0
NC 150 E	0	15	0	0	2772	1314	1314	0	0	0	1443	1443	150	0	2772	15	150
SR 1148	0	0	0	0	0	9	9	9	9	0	11	11	20	0	0	0	0
NC 150 S	0	0	0	0	0	63	63	63	63	0	63	63	0	0	0	0	0
SR 1195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR 1194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR 1003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR 1164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1235**	**55**	**5**	**10**	**2772**	**1404**	**1404**	**99**	**99**	**0**	**1542**	**1542**	**172**	**1598**	**2772**	**392**	**150**
External	**PT1**	**PT2**	**PT3**	**PT4**	**PT5**	**PT6**	**PT7**	**PT8**	**PT9**	**PT10**	**PT11**	**PT12**	**PT13**	**PT14**	**PT15**	**PT16**	**PT17**
SR 1161	567	3367	0	0	0	1400	0	1400	0	0	0	0	0	0	0	567	0
SR 1158	0	0	600	0	0	350	600	350	0	0	0	0	0	0	0	457	0
NC 150 E	0	0	0	0	5287	3000	0	2287	0	0	0	0	0	0	5287	7687	2400
SR 1148	0	0	0	0	0	0	0	383	383	0	0	0	583	0	0	0	0
NC 150 S	0	0	0	600	0	0	0	2000	2000	0	2769	2769	0	0	0	0	0
SR 1195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR 1194	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0
SR 1003	0	0	0	0	0	2642	2642	642	642	0	0	0	0	0	0	0	0
SR 1164	0	9	0	0	0	0	0	62	0	0	0	0	0	0	0	0	0
Total	**567**	**3376**	**600**	**600**	**5287**	**7392**	**3242**	**7124**	**3025**	**80**	**2769**	**2769**	**583**	**0**	**5287**	**8711**	**2400**
Internal	**PT1**	**PT2**	**PT3**	**PT4**	**PT5**	**PT6**	**PT7**	**PT8**	**PT9**	**PT10**	**PT11**	**PT12**	**PT13**	**PT14**	**PT15**	**PT16**	**PT17**
Zone 1 to	0	0	600	1800	2050	1050	600	1400	750	0	100	100	0	0	0	0	0
Zone 2 to	0	200	600	0	0	1200	600	1400	1400	0	0	0	500	0	0	0	0
Zone 3 to	0	0	0	0	700	0	0	900	300	0	200	0	100	0	700	0	0
Zone 4 to	0	0	0	0	0	0	0	200	200	0	200	0	200	0	0	0	0
Zone 5 to	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0
Zone 6 to	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**200**	**1200**	**1800**	**2750**	**2250**	**1200**	**3900**	**2650**	**0**	**600**	**100**	**800**	**0**	**700**	**0**	**0**
Total Trips	**1802**	**3631**	**1805**	**2410**	**10809**	**11046**	**5846**	**11123**	**5774**	**80**	**4911**	**4411**	**1555**	**1598**	**8759**	**9103**	**2550**